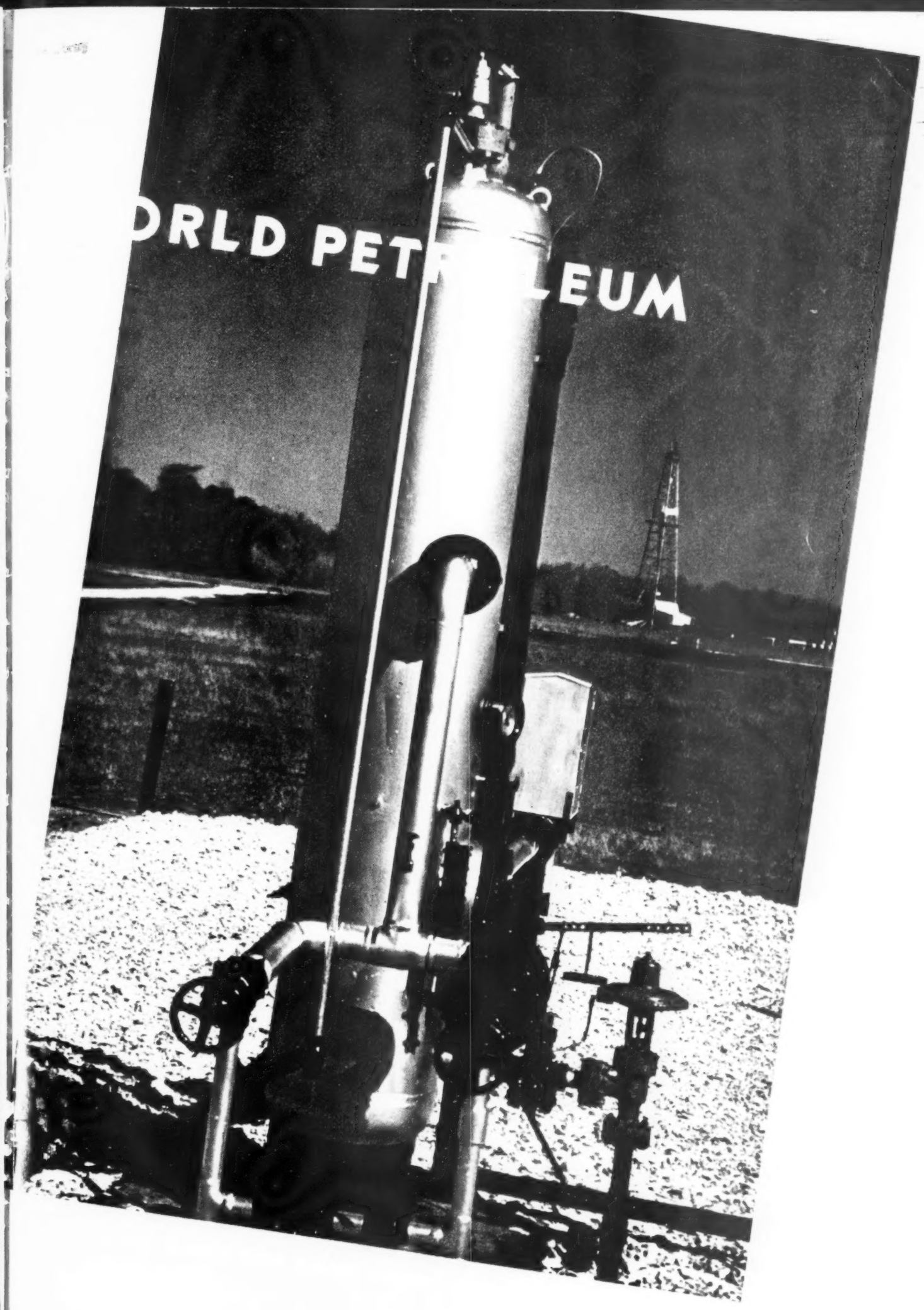

ORLD PET LEUM

Cargoes Afloat!

Partner with the automobile in the development of modern transportation . . . partner in the Victories of two World Wars . . . STA-VOL-ENE the "Natural" known throughout the World, is now ready for peace time cargoes to World Markets.

Hanlon-Buchanan, Inc

PIONEER NATURAL GASOLINE MANUFACTURER

EXPORT TERMINALS:
Goodhope, La. Corpus Christi, Tex.
Houston, Texas Texas City, Texas
Baytown, Texas Galena Park, Texas

TULSA 1, OKLAHOMA
NATIONAL BANK OF TULSA BUILDING
PHONE 4-1101 or L.D. 358 WIRE — OR WRITE P. O. BOX 1559
Cable Address STAVOLENE Tulsa, U. S. A.

FOREIGN REPRESENTATIVE:
Banks, Williams & Co., Ltd.
4 Lloyd's Ave.
London, England

WORLD PETROLEUM

PUBLISHED BY MONA PALMER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

VOLUME 17 | JANUARY, 1946 | NUMBER 1

CONTENTS

1946 A Year of Transition 35
Oil Industry Faces New Conditions in 1946 36
Natural Synthetic Rubber Ample for Future Needs 41
Increased Prospects for Diesels 42
New Soviet Refinery in Turkmenia 45
1946 A Transition Year in Passenger Cars 46
Industry Committee Report 48
Catalytic Cracker for Small Refiners 53
Oil Titles in Latin America 54
"Cat" Craking Growth Spurs Oil Burner Research 50
Oil Company Staff Changes 58
Miniature Oil Field Electrically Operated 60
Washington Notes 61
Hydraulic Pumping of Oil Wells 62

Front Cover — Light Pressure Separator in Humble Oil Refining Company's Clear Lake Field Near Houston

Rex W. Wadman
General Manager

E. W. Mayo
Editor

J. C. Chatfield
Managing Editor

Sofie Cihowski
Assistant Editor

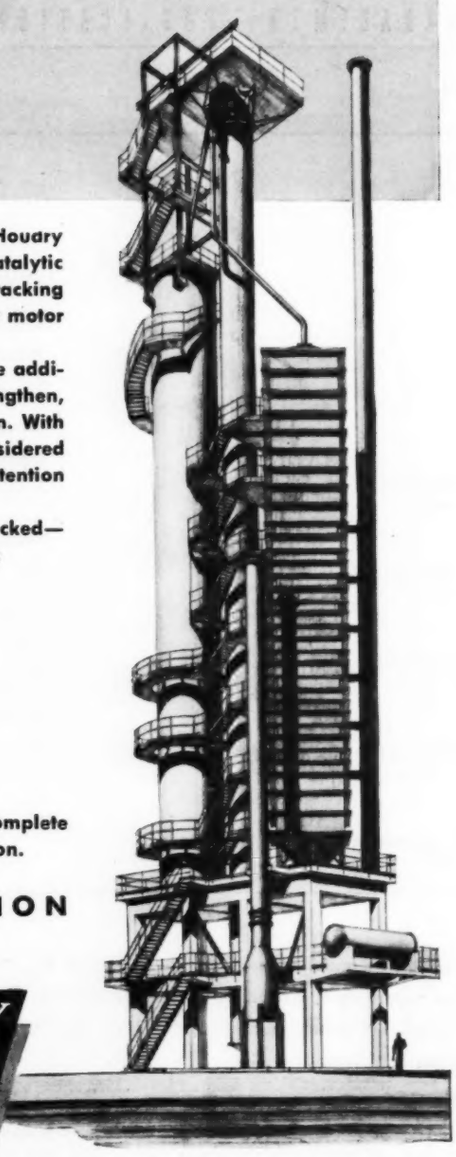
H. Arnold Jacobsen
Art Director

SUBSCRIPTIONS: Annual subscription is offered at the flat rate of $5.00 (U. S.) postpaid. Single copies are obtainable at 50 cents. • Address all correspondence regarding subscriptions to the publishers at Orange, Connecticut, or 2 West 45th Street, New York 19, N. Y. Address all correspondence regarding editorial and advertising matters at 2 W. 45th St., New York 19, (Tel. MUrray Hill 2-7333). Published by Mona Palmer Trustee under the will of Russell Palmer.

BRANCH OFFICES: London: Georgian House, St. Jame's, London, S. W. I. • Mid-Continent Advertising Manager: O. F. Cozier, 515 McBirney Bldg., Tulsa 3, Okla. (Tel. 4-5555) • Mid-West Advertising Manager: Wilard R. Cotton 307 No. Michigan Ave., Chicago 1, Ill. (Tel. Franklin 2508) • Michigan Manager: R. F. Pickrell, 314 Stephenson Bldg., Detroit 2 (Tel. Trinity 1-0790) • Cleveland Advertising Manager: Frank J. Enright, Union Commerce Bldg., Cleveland 14, Ohio (Tel. Main 5693). Western Advertising Manager: Walter S. Johnson, 412 West 6th Street, Los Angeles 14, Calif. (Tel Mutual 1391). Eastern Advertising Manager, Ralph F. Scholbe, 2 West 45th Street, New York 19, N. Y. (Tel. MUrray Hill 2-7333).

MEMO:
To small refiners

The most recent TCC license is for a 3,000 B/D unit!



Leonard Refineries, Inc., of Alma, Michigan, becomes the 17th Houdry licensee and will shortly construct the 69th Houdry-licensed catalytic cracking unit. It will be a 3,000 b/d T C C unit—the first catalytic cracking unit of such small size to be built by private capital for post-war motor gasoline production.

As the war's end approached, Leonard foresaw that only by the addition of catalytic cracking facilities could it hope to maintain, and strengthen, its position under the competitive conditions of post-war operation. With characteristic thoroughness, the company's officials carefully considered the merits of all catalytic cracking processes, paying particular attention to their suitability for an operation of relatively small size.

When all the figures were in—and checked and double-checked—Leonard chose T C C, convinced by these outstanding advantages:

- **higher percentage of on-stream time**
- **greater flexibility of operation**
- **low investment cost**
- **low operating cost**
- **high liquid recovery**
- **high quality and yield of gasoline**
- **stable products**
- **continuous engineering service**

To any interested refiner, Houdry will be glad to furnish a complete economic analysis of catalytic cracking for his particular operation.

HOUDRY PROCESS CORPORATION
WILMINGTON, DELAWARE
New York Office: 115 Broadway, New York 6

Houdry Catalytic Processes and the T C C Process are available through the following authorized firms:

E. B. BADGER & SONS CO. Boston, Massachusetts
THE LUMMUS COMPANY New York City, New York
BECHTEL-McCONE CORP. Los Angeles, Calif.

HOUDRY CATALYTIC PROCESSES
FOR VICTORY IN WAR AND PROGRESS IN PEACE

EDITORIAL

1946 A YEAR OF TRANSITION

AT the dawn of 1945 the petroleum industry was engaged in the grim task of raising the record output of the year then just completed to still higher levels to meet the ever rising requirements of a war that grew more savage and more insatiable in its demands for oil month by month. At that time there were no reliable signs of an early end to the conflict. The Battle of the Bulge, last desperate drive of the German war machine, was still in progress. In the Pacific the Japanese had been driven to the defensive but still fought stubbornly and showed no evidence of the collapse that was to come seven months later. Allied military leaders had become convinced that oil would win the war and were putting greater and more powerful bombing and fighting fleets into the air, sending more mobile units to the battle fronts and turning more ships against the enemy's island strongholds.

In implementing its strategy of an all-out oil-borne attack the high command called for larger and larger supplies of aviation fuel, motor gasoline and fuel oil. Like an athlete who has run a gruelling race but who gathers extra steam for a fast sprint down the final quarter the men of the oil industry put on the extra power needed for the final run to victory.

Now, with the war over, the industry faces a new set of problems. It has been repeatedly said that 1946 will be a year of transition. The designation is suitable enough but the questions of special interest to oil operators are how rapidly the transition will proceed and how complete it will be. In this connection it is worth while to remember that while enormous quantities of oil were used for military purposes during the late struggle the amount applied to civilian use in the United States was constantly two and a half times that provided for the armed forces. Though the consumption of gasoline and some other products by individuals was drastically restricted it absorbed well over three million barrels of oil daily.

Requirements of the military establishment in its reduced state are estimated at not more than one third of the peak demand of the war period. Increasing consumption by the petroleum using public will not fill the gap thus left but, so far as production is concerned, it admittedly would be unwise even if possible to maintain the abnormal rate of withdrawal established to meet top wartime needs which required the operation of numerous fields above their maximum efficient rate. State regulatory bodies and large producers recognized this fact by reducing output immediately after V-J Day. In the two leading oil states of Texas and California alone daily production was pulled down by 500,000 barrels. Estimates for 1946 forecast a daily production of somewhere about 4,100,000 barrels for the country as a whole. This may still be somewhat above actual daily needs but a considerable volume of oil can be readily absorbed in building up stocks which are much below the level normally maintained before the war.

One of the conditions frequently cited as a possible cause of embarrassment to the refining industry after the war was the greatly enlarged capacity for the production of high octane gasoline resulting from the construction of a large number of new units to supply aviation fuel for military use. It was pointed out that post-war commercial demand for this particular product would be perhaps one-tenth of its highest war outturn. Assuming that many of these plants could be converted quite readily to the making of lower octane gasoline it was predicted that there might be a large oversupply or that an "octane war" might develop between large refiners which might force out of business many of the smaller refiners without equal facilities. Although vigorous advertising campaigns have been put under way by various companies extolling the superior motor fuels and lubricants that they are offering the public there is no indication thus far that competitive activity will be carried to the point of seriously endangering market stability.

It is generally agreed that while a decline in gasoline consumption is practically certain as a result of the delay to which the automotive industry has been subjected in turning out new cars a substantial rise in the use of light and middle distillates is to be anticipated. Shortages of kerosene and fuel oil have been reported from various sections and refiners have been advised to alter their operating practice to provide a larger output of these products and smaller cuts of gasoline. To the extent that this is done it will serve to relieve pressure on the automotive fuel market.

One of the serious uncertainties faced by the industry is the question of price control. From within the OPA comes a definite statement of intention to keep the present regulation of prices in effect until settled conditions are restored. In point of fact there is no evidence of serious unsettlement anywhere in the oil trade and a strong case could be made to prove that the arbitrary price arrangement now officially maintained is the most serious obstacle to the adjustment of oil products to fit the changes taking place in consumer demand. There is of course a possibility that Congress may decide to do away with OPA and all its works by June 30. So far as the oil industry is concerned, the early removal of all controls following the example set by PAW would be welcomed as the best means of hastening the return to full normal operation.

Oil Industry Faces New Conditions in 1946

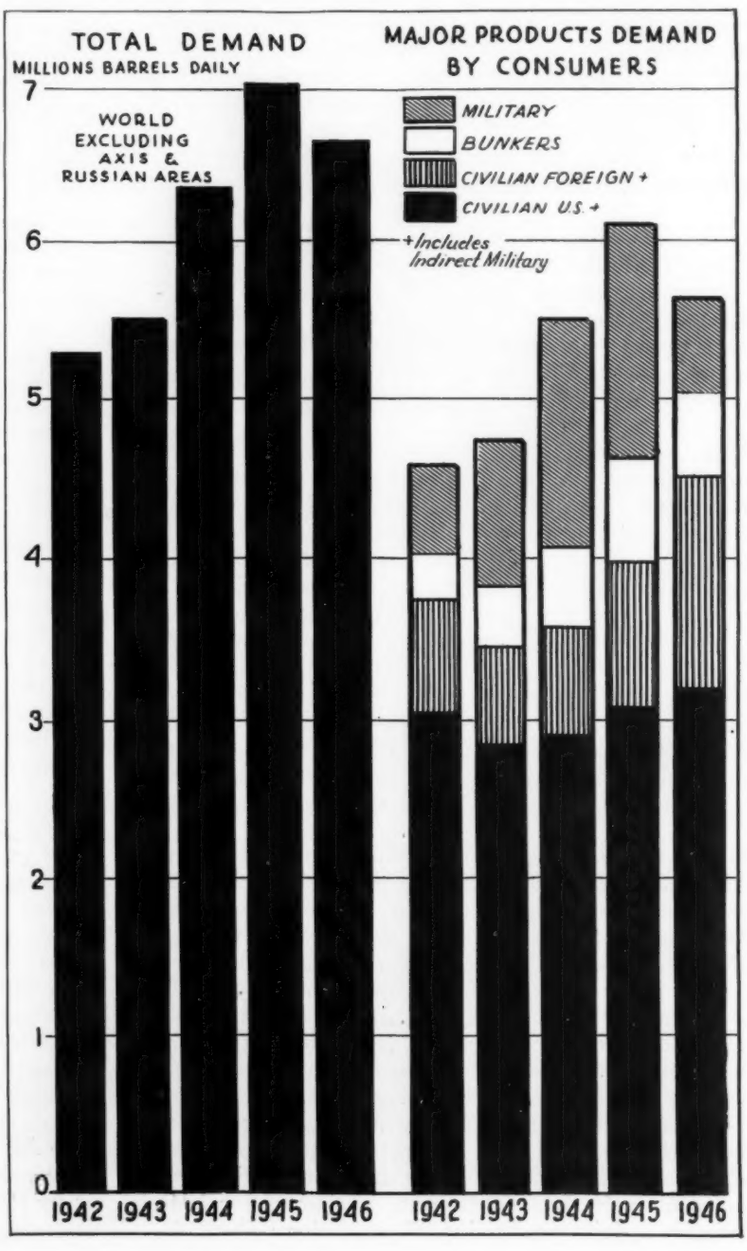
Disappearance of War Demand and Lag in Restoration of Full Peacetime Conditions Point to Temporary Over-supply Despite Material Decline in Production — Development Activities in Middle East and Caribbean Indicate Continuing Growth of Crude Output in Those Areas — Shifting Product Demands Calls for Revision of Refinery Practices — Long Range Outlook Encouraging.

THE year 1945 marked a definite turning point in the world oil situation. For five years oil operators not only in the United States but in all neutral and belligerent countries had been under constantly mounting pressure to increase production to the utmost attainable limit. During the latter part of this period while output was steadily rising among the United Nations the oil facilities of the Axis powers and the regions under their control were being systematically reduced by the bombing of refineries, storage installations and transportation equipment. Thus an abnormal growth stimulated by war was going on in certain countries while destruction of the means of production and distribution was taking place in others. The result was a widespread dislocation of the organization and operating facilities built up to serve the petroleum trade under peacetime conditions.

Despite the forced elimination of a large part of normal production in Europe and the Far East crude output advanced by 250 million barrels or 15 percent between 1941 and 1944 and for the first time exceeded 2,500 million barrels in the latter year, gains in certain parts of the outside world such as the Caribbean area and the Middle East being offset by losses elsewhere as previously noted. In the United States the increase was 273 million barrels or 20 percent. For the three war years 1942-1944 the United States produced 66.5 percent of the entire world supply of oil and provided over 70 percent of the requirements of the United Nations.

Not only did the war bring about extensive changes in oil production but it drastically altered the transportation, manufacturing and marketing operations of the industry. With the tremendous development of the air arm of the fighting forces and the intensification of aerial operations that came with the development of long range planes and the increasing utilization of aircraft carriers as floating bases for air attack the military demand for 100 octane gasoline multiplied at a rate far beyond early expectations and absorbed a large part of the facilities of existing refineries while requiring the construction of approximately a hundred units devoted solely to the making of components of aviation fuel or other specialized products for military use. From 40,000 barrels daily at the commencement of the war the output of high octane gasoline rose to 700,000 barrels daily near the end of hostilities. The maintenance in the field of armies numbering millions of men, operating with motorized equipment, called for a tremendous volume of motor fuel while the movement of troops overseas and the servicing of fleets numbering thousands of vessels demanded vast quantities of diesel and fuel oil. In the early months of 1945 these various needs required the use of 1,700,000 barrels of oil daily. War operations plus civilian use, the latter cut to a minimum of essential needs, were then absorbing a daily output of almost 5,000,000 barrels from the United States plus approximately 2,000,000 barrels from other sources available to the United Nations.

With military requirements mounting constantly and with the knowledge that oil fields in the United States had about reached the limit of safe



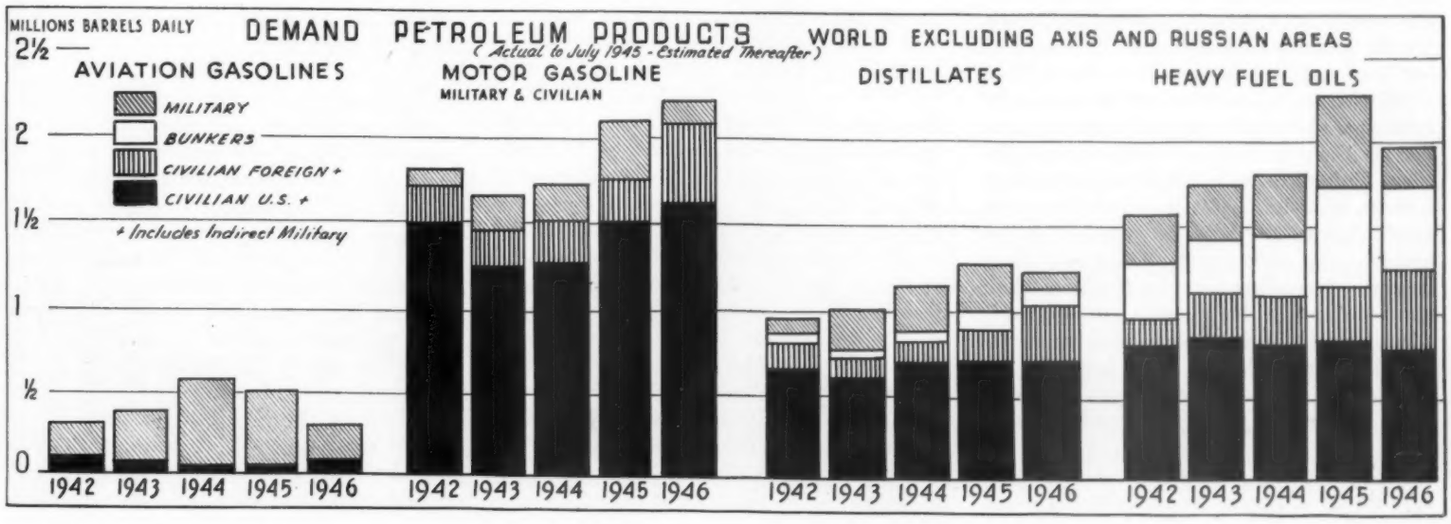
exploitation, some fields in fact being produced beyond their maximum efficient rate, the planning committee of the Petroleum Administration for War early in 1945 had laid down a program for assuring future supplies for the use of the United Nations based on the assumption that the war would continue to the end of 1946. The plan set up included the gradual increase of production outside the United States, chiefly from the Caribbean and Middle East areas, to 2,400,000 barrels daily at the end of the period with an easing of output within the United States to 4,600,000 barrels at that time. Termination of hostilities set aside the completion of this program but production from the Caribbean had advanced to 1,100,000 barrels daily by August 1945 while additional drilling intended to advance production still further was under way. In the Middle East the projected expansion looked to the production of 780,000 barrels daily in Iran and Saudi Arabia. Actual production at the close of the war was roundly 525,000 barrels daily but extensive development work was in progress. Thus, preparations made or put under way under the stress of war are resulting in substantial additions to current productive capacity in these prolific areas.

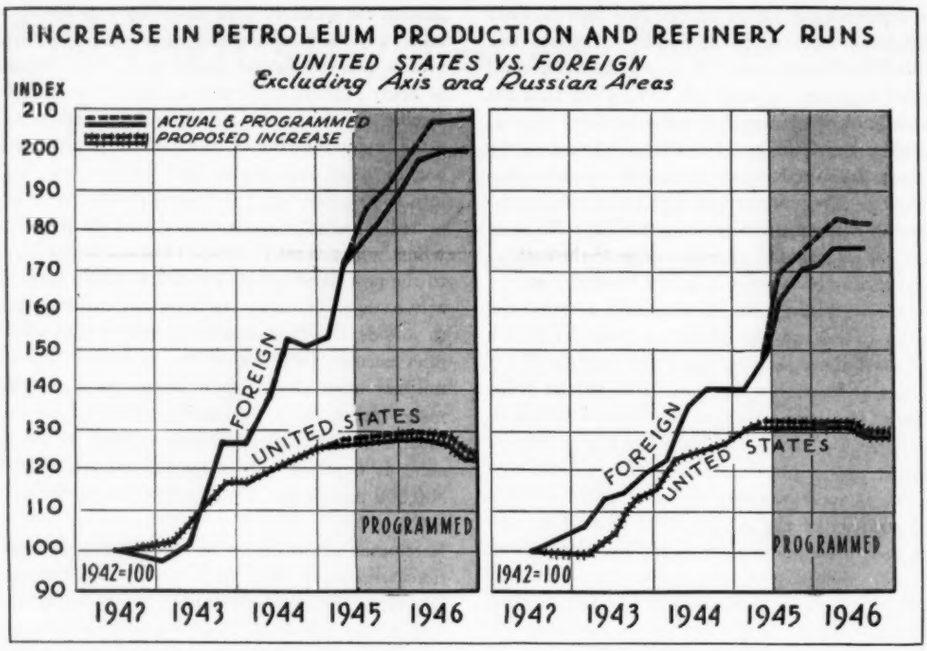
During the early stages of the war, it is worth noting, the advantage in the matter of oil supplies was decidedly on the side of the Axis powers. Germany's swift invasion of Poland and Romania and Japan's rapid occupation of Burma and the East Indies, together with the stocks accumulated by both nations in the years preceding the war, gave them easily accessible supplies for their land and sea operations while the Allies were under the necessity of transporting their petroleum products over long distances. In 1942, following the entry of the United States into the conflict, the active submarine campaign of the Nazis which was directed especially against oil tankers resulted in heavy losses of cargoes in transit and effected a virtual blockade of Caribbean supplies. It deprived the Allies of 600,000 barrels daily that otherwise would have been available and forced the employment of strong escorts for all ocean shipping. It was not until 1943 that the establishment of overland transportation systems between the Gulf and the Atlantic Coast in the United States made good the loss of tankers transferred to other service and that the growing production of fighting aircraft enabled the Allies to take the offensive. From that time on the balance swung heavily to the side of the United Nations. A steadily rising tide of petroleum enabled the Allies to expand the power of their air attack and continuing assaults upon the enemy's oil facilities reduced his fuel resources to the point where ultimately he was unable to fuel his planes or move his ground forces with any degree of effectiveness. The realization that oil-powered machines were winning the war fully justified the strategy of the Allied chiefs of staff in raising their oil supplies to an overwhelming preponderance and in providing for further additions to their petroleum resources that would give positive assurance of victory no matter how long the struggle might continue. The oil industry for its part won the hearty commendation of Army, Navy and civilian leaders for supplying the full volume of products needed in the quantities, at the places and at the times when they were required so that no important operation was prevented or delayed by lack of petroleum.

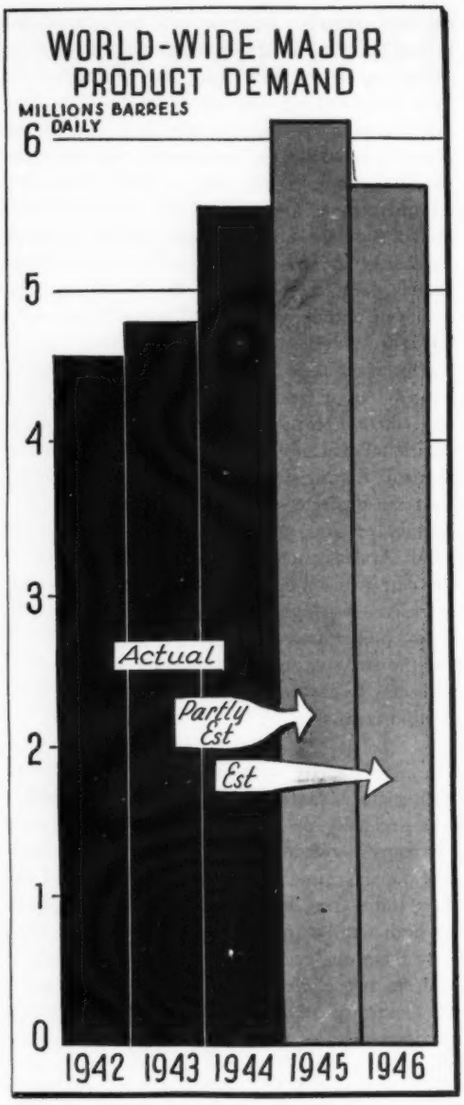
The flood of oil for military use was at its peak in mid-August 1945 when the surrender of Japan completely changed the situation. Combat planes were grounded or remained with their carriers except to the limited extent they were required for patrol duty and the transfer of personnel. Troop movements were halted or limited to the cleaning up of local situations. Petroleum needs for military purposes dropped by 650,000 barrels per day. Most of the decrease was in aviation fuel due to the cessation of air strikes. Mobile equipment of the armies still had to be fueled though the quantity used naturally was less than under combat conditions. Requirements of naval vessels and transports underwent little change as many fighting craft had to be retained in the Pacific and the task of moving service men homeward under the plan of rapid demobilization was one of huge proportions that will extend well into 1946 before any substantial let-up can be expected. Fuel oil, therefore, is one of the products which will remain in active military demand until the process of redeployment has passed its most active stage. Gasoline requirements will continue to subside, however, and it is reported that stockpiles accumulated within the United States by military authorities are sufficient to meet estimated needs for a six month period. After demobilization is completed the military establishment is expected to operate on about 250,000-300,000 barrels per day of petroleum products.

Attempted adjustments to meet changed conditions were undertaken quickly. Upon the recommendation of state regulatory bodies under the lead of the Texas Railroad Commission production in the United States dropped half a million barrels daily and runs to stills followed suit, the decline in this case being accelerated by a series of strikes that closed a number of plants. Crude oil stocks began a slow recovery from the abnormally low level to which they had been reduced by heavy withdrawals during wartime.

Advance estimates of the probable effect of the war's ending upon the oil industry had assumed that a large part of the decrease in purchases of gasoline for military use would be made up by a rise in consumption by individual motorists freed from the restrictions imposed by rationing, that reconversion would offer fewer difficulties to the oil industry than to many others because a great part of the facilities created for the production of aviation fuel could be easily adapted to the manufacture of gasoline of lower octane rating and that a strong demand for petroleum products







would make itself felt quickly from countries that had been unable to obtain supplies during the war years. Various petroleum economists prepared calculations which in general agreed that for the first year following the return to peace demand in the United States consumption would be at about the 1941 level of 3,850,000 barrels daily (although some put the figure as high as 4,100,000 barrels) and that thereafter the resumption of full activity by the manufacturers of motor cars would lead to a rapid increase in the number of automobiles in use and consequently in the consumption of automotive fuel. While differing in details these forecasts substantially agreed that by 1950 consumption would attain to the peak war output of about 5,000,000 barrels daily. Some of them looked further into the future and foresaw a daily United States consumption of 5,750,000 to 6,000,000 barrels by 1960.

The question to which the practical operating man would like to have an answer, however, is not the probable consumption in 1950 or 1960 but how much business he will be able to do in 1946, what kind of products will be most in demand and whether the prices of crude and gasoline are likely to advance, remain stable or decline. Unfortunately, in dealing with statistics it is easier, or at least safer, to forecast long term trends than to determine the immediate future because many unforeseeable factors may cause temporary fluctuations in market conditions which are ironed out in developments extending over a longer period. It is possible however to indicate certain conditions that are to be faced that are fairly certain to have a bearing upon the course of the market during the ensuing twelve months.

Directly following the removal of restrictions upon the use of gasoline by the owners of motor cars, which action took place immediately the news of Japan's surrender was officially confirmed, there was a substantial upswing in sales of motor fuel to passenger car owners amounting to about 400,000 barrels per day but this increase was not sustained in all areas. Rapid reconversion of automobile plants directly following V-J Day gave hope that the production of new cars during the remainder of 1945 would exceed earlier estimates of 200,000 and possibly reach 500,000. Strikes in the factories and difficulty in obtaining materials and parts slowed down output to such an extent that only about one-fifth the latter number of vehicles actually reached the market. Uncertainty regarding the labor situation not only in the motor car field but also in industries such as steel and others which supply essential materials for automobile manufacture casts doubt on the production picture for the coming year.

Should these industrial troubles be cleared up early in the year it may still be possible to turn out four million cars before the end of 1946 but it is not expected that larger estimates of production will be realized. Total demand for automotive gasoline on the basis of 26 million cars in operation may be in the neighborhood of 450 million barrels. Expansion of commercial aviation is proceeding rapidly but requirements for this type of fuel which may be of the order of 50,000 barrels daily will add hardly more than four percent to the demand for gasoline.

One factor favorable to refiners with a high catalytic cracking capacity has been the increased demand by motorists for premium grade gasoline. It is the experience of marketers that the use of this grade fluctuates with the rise or fall in the prosperity of the country, that the more expensive grade is favored when industry is active and employment general. Following the discontinuance of rationing, however, the opportunity to obtain Ethyl fluid and to use cars for longer trips have combined with general prosperity to encourage the use of top grade fuel in comparison with that of lower quality.

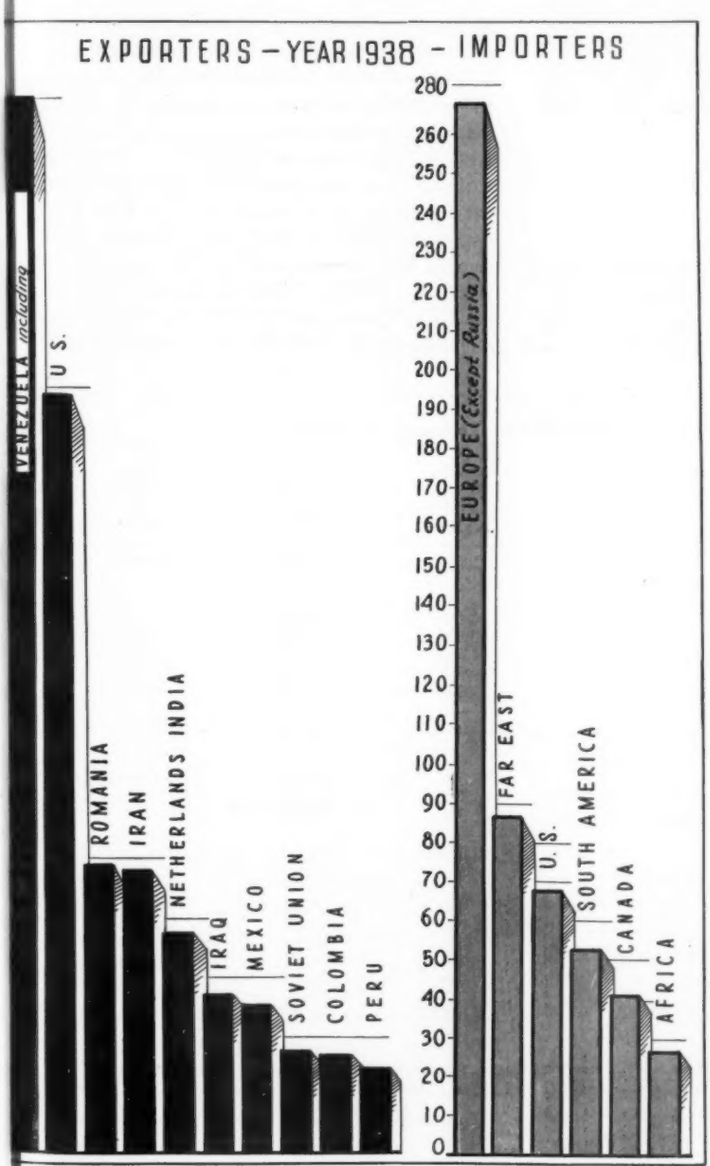
It is generally agreed that consumption of other petroleum products, particularly of light and middle distillates, will increase in comparison with the war or pre-war period. The multiplication of diesel installations during the past few years, the adoption of diesels for trucks and railways as well as for marine transportation and the spread of domestic oil heating under the impetus of the accumulated demand of the war years will combine to raise the use of these forms of fuel by possibly 250,000 barrels daily. With the greatly enlarged size of the American naval establishment the Navy's requirements of fuel will be substantially higher than in the pre-war period. Officers of the Navy's supply service estimate these at around 200,000 barrels daily

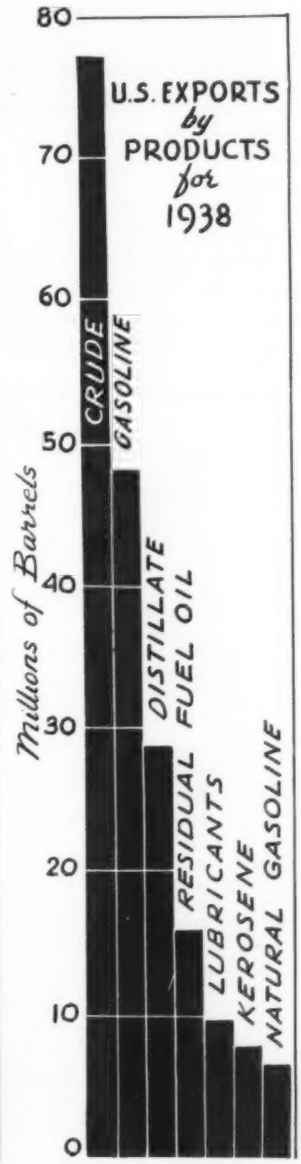
when the fleet has been reduced to its peacetime dimensions. The situation regarding residual fuels is less clear. Catalytic cracking methods have made residuals available for processing to yield gasoline but the most economical source of providing supplies for such processing, at least for East Coast refineries, appears to be through the use of imported heavy oils. The general trend among United States refiners is to minimize the production of residual fuel oils so long as markets can be found for the higher priced elements.

Impending changes in the demand for petroleum products indicate probable changes in refining procedure. With a lessened demand for gasoline and increasing requirements for distillates a modification in the ratio between these classes of products would seem to be in order. Studies based on these estimated changes indicate that an increase of 10 to 15 percent in distillate yields is called for if a shortage of these fuels is to be avoided. They also indicate a temporary need of higher residual output. Under the present fixed price control of petroleum products the changes in ratios between different products are not inviting but shifting market demands are likely to force their adoption and there is, of course, a possibility that price controls may be dropped by the end of June 1946.

According to present forecasts the estimated requirements of the United States market will be met by a daily crude supply of 3,850,000 to 4,000,000 barrels. This represents a reduction of roundly 700,000 barrels from the average output of the past two years and approximately a million barrel decline from the peak of wartime production.

Outside the United States it is more difficult to form an intelligent estimate of probable demand for petroleum products in the immediate future. In Europe, for example, prior to the war, imports amounted to nearly 300 million barrels annually. Principal importing countries were the United Kingdom, France, Germany, Italy and Netherlands, ranking in the order named, with lesser quantities going to the Scandinavian countries, to Spain and Portugal and to Turkey and Greece in southeastern Europe. In the United Kingdom the use of petroleum products is still strictly regulated in order to protect the sterling position. The countries subjected to Nazi occupation have been almost entirely denuded of motor cars, tractors and other oil burning equipment, their transportation systems demoralized and the means of paying for goods from abroad almost entirely lacking. In Germany itself no definite determination has been made as to the policy to be applied in that country, whether its former industrial activity is to be resumed or prevented. Political unsettlement and uncertainty as to the government attitude toward private capital and enterprise are likely to delay action by oil companies toward restoration of their former facilities until they have a clearer view of the conditions under which they must operate. All of these factors affect the return to normal conditions and while all Europe is badly in need of oil burning equipment, it is evident that the process of reinstating lost facilities will move slowly in many countries. It is doubtful whether Europe, normally the most important single market for petroleum products, can utilize more than 50 percent of its former consumption or possibly 150 million barrels during the coming year. In these computations relating to Europe the Soviet Union is not included. Under the plans which it has adopted for its own industrialization Russia presumably will be self contained in the matter of oil and will consume its growing output within its own borders. If it should undertake to engage in export the quantities involved probably would be no greater than those it is obtaining from Romania and Hungary as reparations.





In the Pacific area the demand for petroleum products should equal or exceed that of the prewar period with the one notable exception of Japan. That nation formerly was the largest single importer in that part of the world and was exceeded in the volume of its purchases only by France and the United Kingdom in Europe and by the United States and Canada in the Western Hemisphere. Disappearance of Japan as a substantial purchaser will overbalance any early gains arising from enlarged consumption in other parts of Eastern Asia or Oceania.

Taking the world at large the outlook is that petroleum requirements will fall below the 1944-45 level by something more than 500 million barrels and will be perhaps ten percent less than the figure for 1941. A question of practical importance to oil men, therefore, is the extent of the decrease that will take place in production and how closely the output can be brought into balance with demand. Looking at the production picture in the United States it is a reasonable assumption that daily outturn in the two

states of Texas and California will decrease by 600,000 to 700,000 barrels. It was in these fields that pressure to expand production was heaviest with the result that many of them admittedly were forced to yield above the maximum efficient rate. Elsewhere less drastic changes are to be anticipated unless they are forced upon producers by economic considerations, but the total decrease for the country may amount to 750 million to 850 million, bringing the average slightly below four million barrels daily. On this basis the year's output would be still above the requirements of consumers by the substantial amount of 40 to 50 million barrels although this quantity might logically be applied to the rebuilding of crude stocks which have been drawn down to more than that extent by the overdrafts of the war period.

Calculations as to the relation between production and consumption naturally are affected by the export-import movement. For the three years preceding the outbreak of war in Europe exports of crude and products from the United States averaged 177 million barrels annually. Of crude shipments amounting to something over 75 million barrels approximately one-half went to France, Japan and Italy, countries which obviously will not be markets for any considerable quantities for sometime to come. Except for some 25 million barrels regularly going to Canada and small amounts to a few scattered points the outward movement of crude oil apparently will be practically suspended.

In the case of manufactured products which in the past have formed the bulk of exports from the United States the need for such products in many countries is unquestionable but the means of transporting and utilizing them are lacking as also is the means of payment. It seems doubtful, therefore, whether the export of products within this category will reach 50 to 60 million barrels during the coming year.

Imports to the United States came mostly from the Caribbean and consisted mainly of heavy crudes or residual fuel oil for use in providing products for which it was unprofitable to employ the lighter North American oils. In 1938, the last full year preceding the start of World War II, these imports amounted to roundly 30 million barrels. In view of continued heavy requirements of residual fuel which cannot be economically supplied from domestic sources it appears probable that imports will be maintained for this purpose. The balance between American exports and imports may be narrower than before the war but with the margin still on the side of export.

Reduction of output by producing areas in other parts of the world may be more difficult to accomplish. As previously noted the greatest rise in production has taken place in the Caribbean district and in the Middle East. It has been attained by the bringing in of new fields or of new and prolific wells in existing fields. In furtherance of the program laid down by Allied councilors on the premise that war in the Pacific might continue through 1946 additional exploratory drilling was undertaken before Japan's final surrender and it is practically certain that this will lead to further increase of potential production from these areas. Enlarged facilities in Iran, Iraq, Saudi Arabia and around the Caribbean may add 125 million barrels to the production of these countries in comparison with 1944. In other oil producing regions no great increase is to be expected. Borneo will return to the ranks of producers in the Far East but in Netherlands India disturbed conditions probably will delay the resumption of full scale production. In the aggregate the supply of oil from countries outside the United Stats may exceed the requirements of these areas by as much as 400 million barrels.

In a statement prepared by the Program Division of the Petroleum Administration for War a comparison of worldwide demand for the major products of petroleum is computed as follows in thousands of barrels daily:

World-wide Major Product Demand

	Thous. Bbls. Daily
1942 Actual	4,561
1943 "	4,788
1944 "	5,543
1945 Partly Estimated	6,120
1946 Estimated	5,684

"World-wide requirements will probably reach a low point in the second or third quarter 1946" says the report, "and will increase steadily thereafter in spite of declining military use. The relationship between products will be abnormal during the winter 1945-1946. Gasoline requirements will be unusually low in comparison to the kerosene, distillate, and residual requirements during this period. After the winter the estimates indicate a more normal relationship between products but with a continued high percentage for kerosene and distillates."

Bunker requirements are calculated at 497,000 barrels daily and military demand at 632,000 barrels daily for 1946, both on a worldwide basis. Civilian demand for major products in the United States is estimated by this report at 3.26 million barrels daily in 1946 divided as follows:

Product	Thousands of Bbl.
Motor Gasoline	1,641
Kerosene	199
Distillates	511
Residual Fuel	911

World requirements of major products are estimated to average 5,685,000 barrels daily during 1946 with crude production 6,275,000 barrels.

While 1946 is marked as a year in which production will be in excess of world requirements, in contrast to the period of heavy war demand, the outlook is by no means alarming to the oil industry since stocks in many parts of the world are in need of replenishment. Statistical authorities are in substantial agreement that the condition of oversupply will be only temporary and that in 1947 and following years demand will increase rapidly with requirements rising by 1950 to 5,000,000 barrels daily for the United States and 3,000,000 barrels for outside countries or 8,000,000 barrels for the world.

CRUDE OIL PRODUCTION Thousands of Barrels

	1943	1944	1945
NORTH AMERICA			
United States	1,505,693	1,678,500	1,711,000
Canada	10,100	10,500	9,500
Mexico	33,795	36,000	41,500
Trinidad	22,000	24,000	24,000
	1,571,588	1,749,000	1,786,000
SOUTH AMERICA			
Argentina	24,400	24,500	23,500
Colombia	10,580	22,500	25,000
Peru	14,500	21,000	18,500
Venezuela	182,550	267,000	276,000
Other	3,000	3,500	13,000
	235,030	338,500	356,000
EUROPE			
U. S. S. R.	240,000	270,000	285,000
Romania	36,500	22,000	15,000
Other	16,325	27,000	26,500
	292,825	319,000	326,500
ASIA			
Bahrein	7,000	7,000	7,500
Iran	78,000	102,000	114,000
Iraq	25,350	29,000	35,000
Saudi Arabia	5,750	9,000	20,000
Other	24,800	36,000	11,000
	140,900	183,000	187,500
AFRICA			
Egypt	9,100	9,000	9,000
WORLD TOTAL	2,249,443	2,598,500	2,665,000

Natural and Synthetic Rubber Ample for Near Future Needs

High Demand In 1946 and Slow Rehabilitation of Far Eastern Plantations Will Delay But Not Eliminate Necessity For Reaching Workable World Policy

CURRENT public hearings at Washington on rubber are intended to be used as a basis for mapping the nation's policy with respect to maintenance of the domestic synthetic industry. At the conclusion of the hearings William L. Batt, Chairman of the Inter-Agency Policy Commitee of rubber of the Office of War Mobilization and Reconversion, will prepare a report and recommendations for the consideration of the President and Congress.

The policy committee will have a great deal of information available as a result of the recent London meeting of the International Rubber Study Group comprising representatives of the governments and rubber interests of the Netherlands, the United Kingdom and the United States. The American delegation to the second London conference was headed by Donald D. Kennedy, chief of the International Resources Division of the state Department.

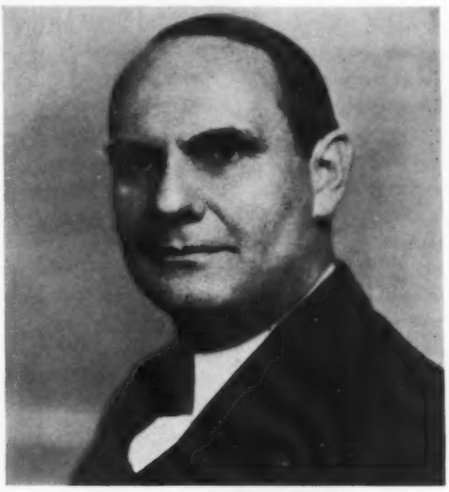
Other members of the study group from the United States were A. L. Viles, president of the Rubber Manufacturers Association; P. W. Litchfield, chairman of Goodyear Tire and Rubber Co.; Harvey S. Firestone, president of Firestone Tire and Rubber Co.; John L. Collyer, president of B. F. Goodrich Co.; George M. Tisdale, vice-president of U. S. Rubber Co.; and E. Stuart Hotchkiss, chairman of Cambridge Rubber.

Information before the London conference from the Far East tended to allay fears of an early rubber crisis resulting from the large world synthetic capacity and the supply of natural rubber available for 1946. The long-term prospect, however, is far from rosy.

Reports from Indo-China indicate that there has been no damage to trees on rubber estates and that in Malaya not more than 10 percent of the trees have been destroyed during the Jap occupation. No reliable information is as yet available from the Netherlands Indies.

The group discussed measures being taken to rehabilitate the natural rubber producing areas. In view of the disturbed political conditions, the severe shortage of labor, equipment, food and other consumer goods and the disrupted transportation system which will require extensive repair and re-equipment, the group decided that any figure of the future rate of production must remain conjectural for some time to come.

Stocks in various parts of the Far East at the time of liberation were estimated at from 200,000 to 300,000 tons, but it is not known how much of these will actually be assembled and shipped.



William L. Batt, Chairman of the Inter-Agency Policy Committee.

While emphasizing the tentative nature of any conclusions, the group suggests that supplies of natural rubber becoming available from all areas of the world including the Far East during 1946 might reach approximately 600,000 tons. If needed, production of natural rubber in three or four years could approach 1,500,000 tons a year.

Synthetic rubber capacity of the United States now is about one million tons per year. Other nations have a capacity of about 400,000 tons.

Combining the potential natural rubber capacity of 1,500,000 tons and the synthetic capacity of 1,400,000 tons the potential supply within a reasonable period will be on the order of 2,900,000 tons. Some authorities put natural rubber capacity at 1,600,000 tons and total world potential at 3,000,000 tons.

Careful estimates of post-war world consumption suggest that demand will not exceed 1,500,000 tons per year, roughly half of the potential supply. While labor and other conditions will postpone the period of critical oversupply, it is still is a situation which must be faced in the future.

A. L. Viles, president of the Rubber Manufacturers Association, stated on his return from London that American rubber manufacturers feel keenly that "The United States must see to it as a matter of broad basic policy, that we produce enough synthetic rubber to know how to make it better and how to use it better."

For the immediate future Mr. Viles pointed to the tremendous pent-up demand for tires and other rubber goods in the United States as a factor which will postpone any crisis. He believes that 900,000 tons of rubber will be consumed in the United States in 1946 and that two-thirds of this will be synthetic. With synthetic producing costs falling he suggests that important new uses for rubber will be devised to help soak up the potential surplus.

Since his return from London, John Collyer, president of The B. F. Goodrich Company, has stated that three basic considerations must guide consideration of the future of rubber:

(1). Peace-loving nations can never again afford to risk their freedom through a famine of rubber. It is a vital factor of military power, as indispensable as steel or oil.

(2). Consumers must have the highest quality rubber products at the lowest economic cost.

(3). The approaching world surplus must be constructively attacked.

Mr. Collyer believes that military security of the United States requires the maintenance of a stand-by general purpose synthetic rubber capacity of 600,000 to 700,000 tons and that at least 200,000 tons per year should be produced regardless of cost in order to preserve and develop "know-how". With an anticipated demand for 100,000 tons of special purpose rubbers an annual output of 300,000 tons of synthetic is recommended. At least 25,000 tons of alcohol process rubber plants should be retained plus the low cost petroleum plants.

In the next five years U. S. consumption is estimated at about 825,000 tons per year, 25 percent above 1940, an average of 14 pounds per person compared with 0.8 pounds in the rest of the world. If this latter figure could be increased to two pounds an additional world demand for one million tons would be created. Mr. Collyer suggests that the rubber industry bend its efforts toward increasing consumption through inventive genius and low price. He thinks that natural rubber prices in the immediate future can be as high as 18.5 cents per pound in the Far East but that this should come down to 12 cents as soon as possible.

INCREASED PROSPECTS FOR DIESELS

The War Brought Great Improvements in Diesel Engines; Amyl Nitrate Has Proved Effective as an Additive For Upgrading Distillate Oils.

NOW that World War II is over, the automotive engineers have taken stock of what the war has done for the Diesel engine, and, incidentally, have brought up the question of Diesel fuels.

According to surveys contained in reports and papers presented to the Society of Automotive Engineers, the war brought about remarkable changes in the Diesel picture. Production was begun and maintained on a scale sufficiently extensive to permit the development of mass production methods. The output included sizes ranging from one cylinder to twenty four. The forms were greatly varied, from in-line through standard-V, double-V, "porcupine pancake", quadrangular and radial cylinder arrangements. As one report states it, "it was almost as if the Diesel engine builders had set up a crankshaft and then attached pistons and cylinders virtually ad infinitum".

As applied to automotive vehicles, it is pointed out that the Diesel engine made remarkable engineering progress during the war. It now produces one horse power per each 2½ cubic inches of displacement, as compared with 29 cubic inches before the war. Its weight has been reduced from an average of 60 pounds per horse power to a present average of four pounds.

This trend toward reduction of weight and bulk along with increasing power output, has tended to transform the Diesel into a "power package" that can be conveniently accommodated in the design of vehicle or a ship. The reports point out that large bus line companies are planning to multiply their fleets of Diesel-powered buses several times, and that it looks as though the Diesel is destined for peacetime service more vast even than was contemplated in prewar days. Diesel powered passenger cars are "within sight, if not sound", and there are signs that Diesel-powered ships particularly smaller craft, and Diesel-powered airplanes will greatly increase. Stationary Diesel engine installations and Diesel locomotives are also increasing.

Diesel Powered Buses are Used Over Mountain Roads and in New York Stop-and-Go Traffic.

It is further agreed that more and more engineers are coming around to recognize the Diesel as adaptable, powerful, economical, prompt in action, and reliable. It is admitted that Diesels still need refinement, together with weight reduction, improved fueling, lubrication methods, and the overcoming of torsional vibration. It is not thought that simplification and weight reduction have reached the ultimate limits, and some engineers go to the length of believing that with further weight reduction and with supercharging the Diesel of the future will become a serious rival of the gasoline engine for almost any kind of service.

One line that the Diesel-engine designers have been working on is the utilization of the explosive force of the Diesel's exhaust as a source of additional power. This idea is expected to culminate in the union of the Diesel engine and the gas-turbine to make a smoothly operating power plant of superior efficiency.

It was inevitable that the question of Diesel fuels should turn up in this symposium on the Diesel, and at this point the petroleum refiners became interested. Naval engineers were on hand to point out that, from the standpoint of the Navy, Diesel performance depends on both design and quality of fuel, both of which may create independent bottlenecks in progress with fuel improvement generally in the lead. In the past, gains in engine output have been achieved by changes in engine design or materials, which were made to conform to the fuels and lubricants which at that time the oil refiners had made available. At the present time the designers

have come to a point where the use of superior fuels may be justified in present Naval engines, if certain military factors, such as reduction of smoke, increased reliability and decreased maintenance, can be made more acceptable. Superior fuels will be especially necessary for the high output Diesels of the future, just as high octane gasolines are now necessary for the satisfactory operation of the high output gasoline engines in general use today.

When referring to high output Diesel fuels, the first characteristic usually mentioned is that of cetane number. By definition, cetane number is a measure of the ability of a fuel to ignite in the cylinder of a Diesel engine. This characteristic is of extreme importance in obtaining easy starting, smooth running at light loads, and in reduction of smoke. Engine deposits are, to some degree, also a function of the cetane number of the fuels used, since fuels of poor ignition quality usually form a considerable amount of fuel residue. Thus, without question, the cetane number of a Diesel fuel is of definite significance in the satisfactory operation of a Diesel engine.

However, considerable evidence is accumulating which indicates that high cetane number is not the only criterion of quality in a Diesel fuel, particularly from the standpoint of power output. Another characteristic such as "its rate of flame propagation", or "burnability" in the cylinder, may be of equal or even greater importance for use in the high output Diesel engines of the future. While it is highly desirable that the Diesel fuel ignite as soon as introduced into the cylinder, it is equally desirable that the fuel be controlled to burn as completely as possible during the early part of the power stroke, since combustion occurring during the final part of the stroke results in a loss of power as well as burned exhaust valves or parts, stuck piston rings and high cylinder wear.

Train of Diesel Freight Trucks in the West.

The high-speed Diesel engine thus requires a fuel that can be ignited and burned in a very short period of time; hence in the immediate past, most attention has been centered on the cetane number, and it is up to the oil refiner to take charge of this matter.

What are the factors that confer a good cetane number on a Diesel fuel? Of course, other qualities must be regarded, for instance, low pour point. The pour point can be reduced by putting into the fuel less straight-chain hydrocarbons and more branched-chains, but this reduces the cetane number. However, the cetane number is increased by the length of the chains, particularly a single long side-chain in the center of the molecule. Double bonds reduce ignition quality, for which reasons aromatics like benzene and toluene are undesirable, but they gain in this respect if a paraffinic sidechain is added.

Summarizing opinion on the subject, the question of the right kinds of hydrocarbons for a good cetane number in a Diesel fuel, it is concluded that:

(1) Straight-chain paraffins have the best cetane numbers, and the longer the chain the higher the cetane up to a certain maximum.

(2) Aromatic rings will have the lowest cetane number.

(3) In the case of branched paraffins or aromatics it can be said that the lower the number of chains, down to a minimum of one, and the greater the length of these chains, the higher will be the cetane number.

(4) The greater the number of hydrogen atoms per molecule the higher the cetane number, although structural arrangments may overrule this; thus, naphthenes will be better than aromatic or cyclic olefins, and paraffins better than the corresponding aliphatic olefins.

It thus appears that there is a wide scope for the "tailoring" of Diesel fuels, with the important proviso that the oil refiner must be offered sufficient economic incentive to go to the trouble. The modern refining industry has such a great flexibility and range of technique that it can furnish a fuel of practically any quality that consumers are willing to pay for. It is up to the Diesel designers who still have a lot of fundamental research ahead of them. The refiners are now ready with very high cetane fuels, but the fact is that these very high cetane fuels offer no great advantage in Diesel engines of present, just as the automobile gasoline engine cannot make effective use of the super-octane fuels that are now powering military aircraft.

Meanwhile, the steady development of processes for converting gas oils into gasoline, especially the wide scale installation of catalytic cracking during the war, is tending to divert conventional straight run Diesel oils into gasoline production, and to substitute, therefore, cracked Diesel oils of altered composition and combustion characteristics. This has had an unfavorable effect on the cost and supply of Diesel fuels of desirable quality.

Recently the practical problem of good quality Diesel fuel has taken another turn. It is not solely a matter of expensive tailoring of Diesel fuels to order by adjusting and controlling the chemical composition in favor of more paraffinic side chains, less aromaticity, and fewer double bonds, which the refiner is perfectly willing to do if he is sufficiently paid. When it comes to the question of upgrading Diesel fuels, engineers will be indifferent to the method of upgrading, provided it is effective and inexpensive.

Here the matter of additives enters the picture. The discovery of tetraethyl lead as an additive for upgrading automobile gasoline was a tremendous forward step, and it has turned out that additives are available which will render a comparable service to Diesel fuels.

As the matter has stood up to now, the high speed Diesel engine fuel specification has been built around a straight-run petroleum distillate from certain paraffinic crudes in order to obtain a certain minimum ignition quality as expressed by cetane number, or the Diesel index.

But the use of an additive to upgrade Diesel fuels has upset previously conceived notions about the significance of Diesel index. This is particularly true as regards amyl nitrate, which at the moment is attracting much attention as an upgrading additive. For instance, the Diesel index is calculated by the formula Aniline Point, °F. $\times$ Gravity, Deg. API. / 100

By this formula it is found that when amyl nitrate is used the aniline point remains nearly constant and the API gravity remains nearly constant while the Diesel index does not change for the various percentages of amyl nitrate, but the cetane number does change appreciably. Therefore, Diesel index has no relationship with cetane number when amyl nitrate is used as a Diesel additive.

The development of the use of chemical agents have thus brought about new concepts, and make the requirements built around straight-run distillate fuels obsolete for classification purposes.

Reports presented to the SAE on large-scale use of fuels treated with amyl nitrate show that such fuels have proved their effectiveness in various makes of railroad locomotive Diesel en-

gines and do not give rise to harmful deposits or corrosion in the engine and fuel injection system, and also that exhaust smoke conditions are negligible.

In these tests it was found that the response of the fuels to doping with amyl nitrate varied. This is naturally to be expected, since different oils may have different original cetane numbers, due to their different content of straight chain paraffins and aromatics.

In these tests with Diesel locomotives it was found that for maximum increase of cetane number about 0.52 percent (in some cases a little more) was required, while the maximum increased power output was reached with about 0.25 percent.

In the railroad field Diesel-electric locomotives have been taking hold rapidly in recent years and are expected to develop at an accelerated rate in the early post-war era.

It is an astonishing fact that the first Diesel iocomotive was built only twenty-one years ago. It was a "switcher" delivered to the Central Railroad of New Jersey in 1925 and still is operating. A survey made last August showed 2,184 Diesel switchers in use at that time. Most railroads have ceased buying any switchers except Diesels. In January, 1945, the only switcher orders on file with locomotives manufacturers were for Diesels.

It was only a little over eleven years ago that the first passenger Diesel appeared. It was on the morning of May 26, 1934 that the first Burlington Zephyr headed east from Denver. It reached Chicago thirteen hours and five minutes later having covered 1,015 miles at an average speed of 77.6 miles per hour. Top speed was 112.5 miles per hour.

Soon after the appearance of this first streamlined passenger train other railroads began to put on similar equipment. In 1940 there were 116 Diesel passenger locomotives in the country, in 1941 the number had risen to 179. During the war manufacture of passenger locomotives was discontinued so that today there are only about 200 in use. Now that the emergency is over it is anticipated that building of passenger Diesel locomotives will increase.

In the ten years ended December 31, 1944, American railroads placed orders for 6,648 locomotives of all types according to "Railway Age." Of this number 2,143 were for steam locomotives, 4,319 for Diesels and 194 for electric locomotives. In 1944 out of 747 orders placed 670 were for Diesels, 74 for steam and three electric. Out of the 938 locomotives delivered to the railroads in 1944, 608 were Diesel.

As mentioned previously the largest number of Diesel locomotives is in the switching field but recent years have seen the development of the Diesel freight locomotives as an active competitor of steam. The first main line Diesel freight locomotive went out on a demonstration tour in 1939. 300 freight Diesels are in service and 80 combination freight and passenger locomotives.

An important advantage of the passenger Diesel, particularly on long runs, is in the increased speed made possible by reduced stopping time for fuel, water or change of locomotive. Diesels cut 16¼ hours off of the Chicago-California time, 10 hours off the Chicago-Denver run.

Acceleration is faster and curves can be taken at higher speed. A steam locomotive must be refueled every 100-150 miles while a Diesel can run from 500 to 650 miles without taking on fuel.

Water problems of railroads in the arid southwest are solved by Diesels. In one 459-mile stretch on the Santa Fe savings in water pay for a third of the Diesel fuel and all of the lubricating oil used by Diesels. Santa Fe has 78 Diesel freight locomotives on that particular run, 226 on the entire system.

An interesting advantage of Diesels in the mountain region is the use of motors as generators on down-grade runs thus creating a braking action without wear on wheels and brake shoes. Diesels are said to be easier on trackage through elimination of the pounding of drivers by the more constant torque of the Diesel-electric plant.

Diesels are said to give more constant service than steam locomotives because of the small amount of time required for repairs. Parts are smaller and more easily installed so that most repairs are classed as "running repairs", that is, made between runs. Last summer there were 20 high speed passenger Diesels each with more than a million miles serves between withdrawal for overhauling. Steam locomotives require an overhaul every 100,000 to 150,000 miles.

All this development in automotive and railroad Diesels means, of course, that the oil industry will experience a greater call for intermediate distillates in the next few years. Diesel engines will compete with gasoline engines for fuel by taking the best cracking stock for use without processing. Assuming that Diesels will insist on a largely paraffinic type of fuel, it may be possible that refiners will be called on to reverse some of their normal processing procedure and convert unsaturates to saturates.

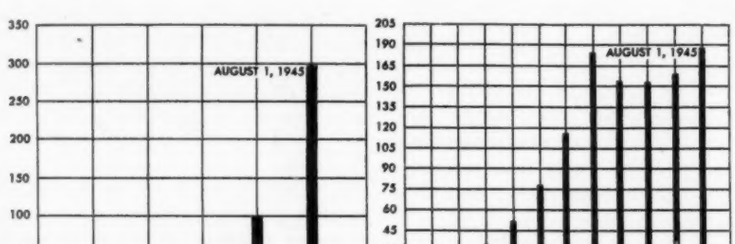
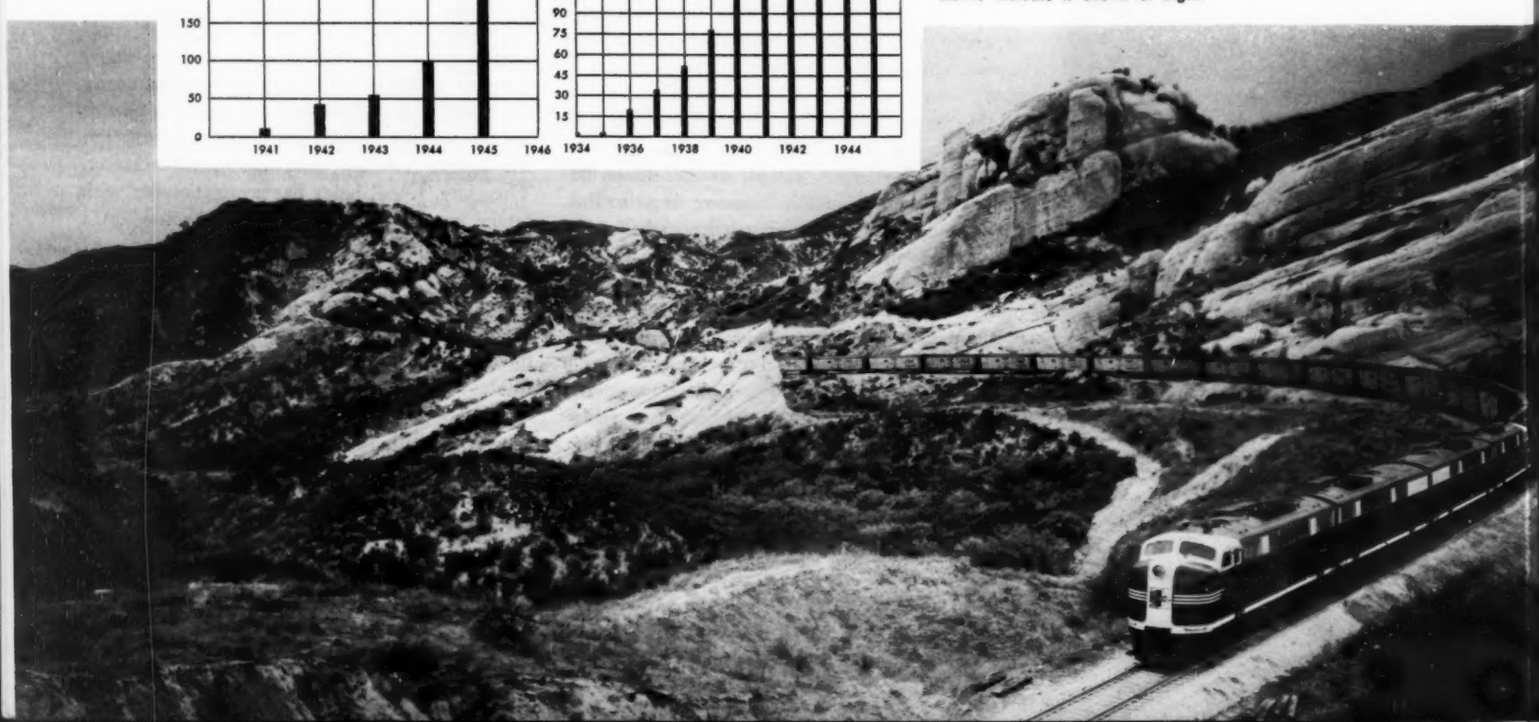


Chart at Left Reflects Rise in Number of Diesel Freight Locomotives During the War. Passenger Locomotive Increase is Shown at Right.

Below: A Santa Fe Freight Train Drawn by Four Diesel-Electric Locomotives.



Left: Turkmen Laborers Engaged in Refinery Erection. When Plant is Put into Operation, They Will Operate Up-To-Date Machinery Under the Guidance of Experienced Foremen.

Delivering Equipment to the Construction Site.

New Soviet Refinery in Turkmenia

Engineers Altukhin (left) and Khrenov Supervise Construction. (Photos by A. Lavrov for Sovfoto)

Assembly of Equipment on the Construction Site.

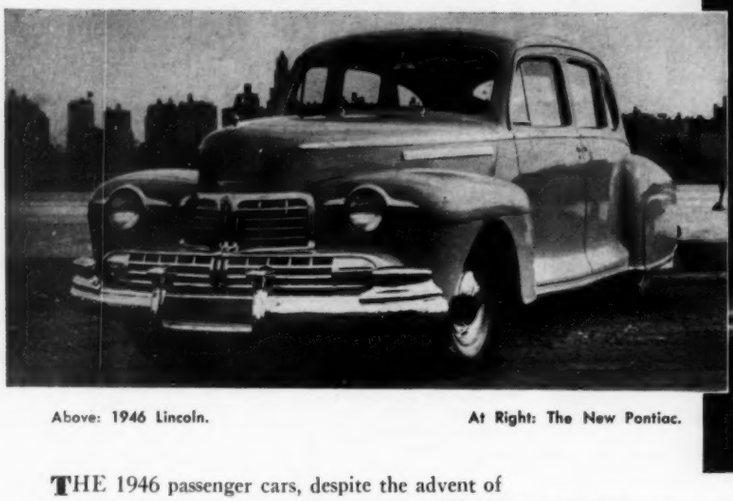
ONE of the important wartime developments in the petroleum industry of the Soviet Union was the construction of a refinery at Nebit-Dag in the rich oil district of Turkmenia, south of Krasnovodsk and across the Caspian from Baku. The plant is a noteworthy addition to the growing oil industry of Central Asia. It processes crude from the local wells and from other Central Asian producers.

Exploitation of the Nebit-Dag field began little more than five years ago, as one of the projects of the third five-year plan, but was speeded up during the war as the German invaders engulfed or threatened the major oilfields of the North Caucasus and Baku. Largely as a result of wartime expansion, Turkmenia's petroleum production is now estimated to be more than six times the pre-revolutionary output. The Turkmenian state budget was increased by more than one-third in 1944 to expand the production and processing of petroleum.

While Nebit-Dag, which means Petroleum Mountain is the principal Turkmenian producer, prospectors recently discovered other rich resources of oil in Turkmenia. Prolific beds have been found in the salt marshes and the vast Kara Kum desert, which covers much of this Central Asian republic.

Turkmenia is one of the sixteen republics constituting the Soviet Union. Previously a land of sand and primitive agriculture, Turkmenia set up a network of industrial enterprises during the years of Soviet power, which completely changed her economy. The industrialization of the republic assumed wide scope, particularly during the war. New factories and mills have sprung up in recent years and today the attention of the Turkmenians is focused on the construction of a giant oil refinery plant. Geologists long ago considered that Turkmenia which adjoins the oil regions of Azerbaijan must be rich in oil deposits. Extensive prospecting proved that the geologists were right and an oil industry was set up. The refinery now under construction in Turkmenia will be one of the biggest of its kind in the Soviet Union. Construction work goes on with increasing speed and the builders will, undoubtedly, complete their job considerably ahead of schedule. The accompanying pictures show the construction activities.

1946 A Transition Year in Passenger Cars



Above: 1946 Lincoln.

At Right: The New Pontiac.

THE 1946 passenger cars, despite the advent of the Atomic Age, come equipped with refillable fuel tanks, gear cases that need draining and replenishing, and fittings that require various kinds of greases.

These specifications insure a continuing market for automotive type fuels and lubricants, with domestic demand expected soon to exceed pre-war levels in volume. Meanwhile refiners, compounders and blenders, and marketers scan the post-war assembly lines for indications of trends that will set the pace for petroleum products in the future.

The motor fuel situation for the present at least, is primarily an intra-oil industry affair. Refiners are preoccupied with technological and economic questions concerning the post-war uses of facilities for producing components that were required for aviation quality fuels. As a consequence, the quality of fuel now sold to the the public is dictated by these questions rather than by the demands of the automobile engine. The public knows of this through advertising and sales promotion announcing that automotive fuels have returned to pre-war quality and that in some areas they now exceed the former standards. Improved fuels are welcomed gratefully by motorists after the struggle with wartime fuels limited in both quantity and quality.

Engines in the first post-war models are virtually the same as in 1942 models. This is quite understandable. Research during the war was on military equipment, and in the necessary haste now to get some cars out to replace war worn vehicles the obvious course is to pick-up where assembly lines left off in 1942.

While little importance is attached to the relationship of fuels and engines at the moment, this actually is a formative period. The quality of fuel marketed this spring and summer will determine in a large measure the advancements in engine design for 1947 automobiles.

Obviously, it would be disastrous to zoom into production with a power plant for which suitable fuel could not be bought at about every cross roads service station. Refiners and car manufacturers would be deluged with complaints about poor performance. This is especially the case with the lower priced, mass market automobile engines, although some higher priced makes seek engine performance superiority through use of designs that demand about the highest grade fuels on the market.

Refiners, on the other hand, are not in a better position by marketing fuels too far in advance of engine requirements. The great majority of engines would not benefit from such fuels, and higher refining costs would thus be a burden on the motorists.

Before the war the general situation was in balance through a fairly constant relationship between available fuels and engine design. They advanced pretty much in step with each other, and there is every reason to predict that this relationship will be resumed.

The next few months are quite likely to be the basis for engine advancements. Car manufacturers will be following fuel trends closely. The areas with gasolines of the highest quality will likely encourage some manufacturers to design engines for these fuels. The general level of quality throughout the country is likely to set the pattern for fuel requirements of engines in volume production cars.

While refiners are having a field day among themselves in supplying better and better fuels, the lubrication situation is a joint activity. The first post-war models point up additive type motor oils, all-purpose gear lubricants, and extension of the service interval recommendation.

Technical advancements in motor oils through the use of additives were well on the way prior to the war, especially in the truck engine field where there is plenty of hard service encountered. These were pretty much on the scientific plane as to phraseology, but since the public dotes on slogans and snappy phrases this trend emerges in the post-war world under the banner of heavy duty type motor oil. The phrase was pushed along by the armed services establishing a specification and using this type of oil quite widely in military equipment.

The momentous decision now is whether heavy duty type motor oils should be used in passenger car engine crankcases. If so, under what conditions of service, and do you just go ahead and use it or are some special drain precautions in order?

The most significant joint-action developments so far are the recommendations from the general commitee of the marketing division of the American Petroleum Institute. These recommendations define three types of motor oil—Regular, Premium, and Heavy Duty. Attention then shifted to the automotive industry and what recommendations would be made to motorists by the manufacturers through the owners instruction books.

Early returns show a trend to recommending the Regular or Premium types, although several manufacturers refer only to the S. A. E. grades. So far, there has been no rush to embrace the heavy duty type for passenger car service. The time, of course, has been too short for a full appraisal of the entire situation, but the start has been made in a more comprehensive description of motor oils for crankcase service.

Above: Buick.

At Right: Oldsmobile Club Sedan.

The nub of the situation at present is that the A. P. I. has defined three types of oil as to the work they can be expected to produce, and that these definitions are not specifications.

Yet, these definitions may mark the closing period of the pioneering stage of development. The motorist may well ask "What is heavy duty oil?" Again, "Are the qualities of the various brands similar?" Does Heavy Duty indicate that an oil has all the qualities, or do some heavy duty oils have only added anti-oxidation qualities while others are primarily of the detergent type?" It may be that the time is about at hand when technical organizations can consider and establish specifications defining heavy duty oils. The car manufacturer, the refiner, and the owner then would have a similar language, and specific recommendations could be made regarding oil quality.

At the recent meeting of the American Petroleum Institute there was considerable discussion in the hotel lobby—some of it slightly bitter—regarding the use of additives in all branded motor oils. One of the major companies was reported at that time to have decided to use an additive in all automobile oils. Other companies felt that such additives are not necessary at the present stage of development of the automobile engine and that the added cost burden should not be shouldered now for the sake of luring the customer. Additives for diesels, for heavy duty service, yes, but not for pre-war cars or for pre-war cars to be produced in 1946. The motor oil additive situation some suggested was similar to the gasoline situation in which the customer for competitive reasons is being given much better fuel than his motor can utilize.

There was some discussion of the possbile future impact on motor oil of the new synthetic lubricant recently placed on sale at 75 cents per quart in a few test areas by company outside the industry. At present prices, assuming that the synthesis demands such a high level, most industry men do not view the new competitor with alarm.

The "all-purpose" lubricant for passenger car gear service is being pointed up in the first post-war models. The basic idea, especially if it eventually is applied to greases, might well be a fundamental contribution of World War II to the simplification of lubricants.

World War II was noted for simplification of the grades of products required to lubricate military equipment, primarily to ease the supply situation. Equipment turned out by United States factories went into global service. The output of one shift of a tank assembly line, for example, might find its way to Africa where the engines would operate under high atmospheric temperature conditions on air filled with sand while other units went to the northern theaters of war to operate in sub-zero conditions. A wide range of products would be desirable to meet such varied operating conditions. Yet, the practical aspects of having lubricants on hand all over the world called for simplification, and the narrowing of various grades of a given type of product into a few or an "all-purpose" grade.

Domestic marketing, of course, is not confronted with such difficult supply situation, but fewer grades do allow economies. Straight mineral gear oil and extreme pressure gear oil are the old stand-bys, but some manufacturers are not frowning on the use of "all-purpose" gear oil for 1946 passenger car service.

"All-purpose" gear oil is midway between a hypoid and an extreme pressure type lubricant in the various S.A.E. grades. It is to meet the service requirements where hypoid lubricant would be recommended, and also where straight mineral gear oil would be used in gear cases where corrosion would not be a factor.

For those who like to follow trends: watch for greater use of "all-purpose" gear oil for passenger cars, and for simplification in the number of types of greases required by automobiles.

The service interval recommendations are being watched closely by oil men. One car manufacturer recommends chasis lubrication every 2,000 miles against the pre-war advice of 1,000 mile service. There are signs of restlessness over crankcase drain intervals.

To some, these are dark forebodings and the one dark spot on the horizon of the post-war car. What of the future, if there is a general trend towards extending the service interval? Others place what is claimed to be realistic interpretation of such recommendations pointing out that motorists pay little more than lip service to 1,000-mile recommendations. In other words, manufacturers may be catching up with actual practice, not establishing a new trend.

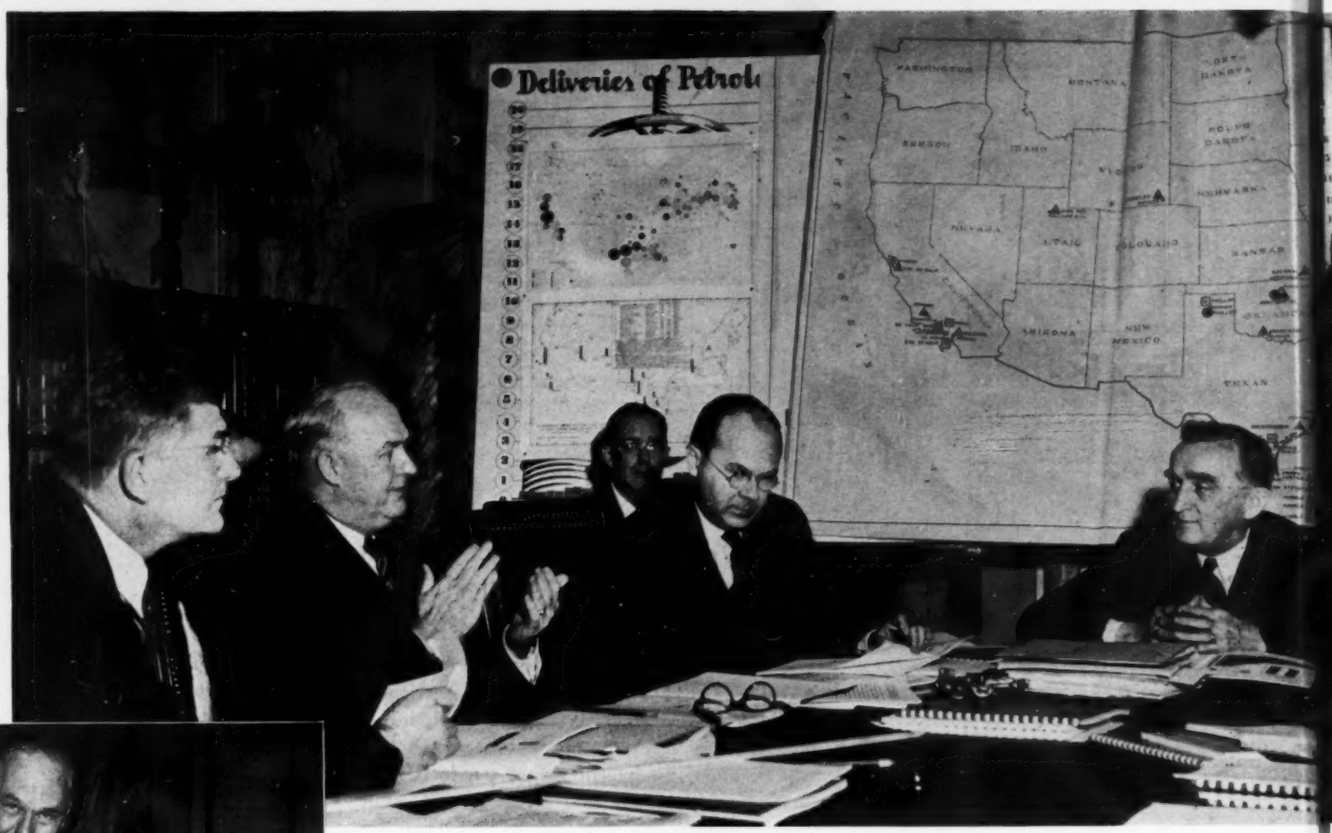
There is one feature bearing on the future of lubricants not apparent from the requirements of the first post-war models. This is the potential market for fluid drive type lubricant. The transmission of power from the engine to the rear axle is admittedly open for improvements. Progress was made before the war in types of gear teeth, in automatic transmissions, and in fluid drives. Better power transmission will be a lively subject among automotive engineers which forecasts interest in the quality of fluid drive lubricant to be required.

The 1946 first post-war model passenger car when viewed by itself without any relation to the pre-war and the following post-war models will cast no lengthening shadow of things to come.

It is a stop gap to fill, in part, the pent up demand for a new car. For the oil man the 1946 model is a back drop while these situations parade across the stage:

For Motor fuels—conversion of refining facilities from wartime to peacetime demands of quality. A time when gasoline satisfies pre-war as well as the 1946 engine requirements, thus permitting the competition on quality to level up to some post-war standard. The quality of gasoline on sale at service stations this summer will set the pattern for 1947 engine requirements and mark resumption of the close relationship of engines and fuels.

For lubricants—consideration of the qualities of motor oil that can be achieved with additives and a period of further progress for future engine progress; valuation of wartime experience in the simplification of products as applied to domestic marketing problems.



Right: Senator O'Mahoney Asks Mr. Jones to Elaborate a Point While Counsel Fraser (Center) and Hines Baker (Left) Listen.

Below: The Army, Navy and Industry — General Peckham, U. S. A.; W. A. Jones and Capt. Franchot, U. S. N.

INDUSTRY COMMITTEE REPORT PROVIDES BASIS FOR DISPOSAL OF GOVERNMENT PROPERTIES

FOR the prosecution of the war just ended $1,725 million was invested in refining and pipe lines for the production and movement of military supplies of petroleum products. In the construction of these facilities the industry expended $960 million or 55.7 percent of the total and the government $765 million or 44.3 percent. The disposal of the government's share in this wartime plant and equipment is a matter of importance both to the oil industry and the public. It is one of the subjects under consideration by the Special Senate Committee Investigating Petroleum Resources.

Before these Senatorial investigators, conveniently referred to as the O'Mahoney Committee since the senior Senator from Wyoming is its chairman a group of 26 oil industry representatives designated as the Committee on the Post-War Disposal of Pipe Lines, Refineries and Tankers, on November 15 presented a comprehensive survey of all the facts regarding these various properties, the story of their development, their performance in support of the war effort and their relationship to the privately owned facilities designed to serve the peacetime needs of the nation and now expanded beyond all previous capacity.

The report was presented under the direction of W. Alton Jones, president of Cities Service Company and chairman of the committee.

The presentation was aided by the display of a series of large charts graphically illustrating the performance of each of the facilities discussed and it was recognized as one of the most masterly and instructive summaries ever presented before a Congressional committee, winning for Mr. Jones and his associates the hearty commendation of Senator O'Mahoney speaking for the members of his committee.

In introducing the report Chairman Jones stated for the record the general principles which his group felt should be applied by the representatives of the government in dealing with surplus petroleum facilities. These are as follows:

(1) The government should not attempt to operate surplus plants, pipelines or other similar facilities. The oil industry believes in the free enterprise system and believes that there is no place in such a system for government in business. There is no halfway measure; free enterprise cannot endure with government as a competitor.

(2) As soon as possible those facilities which are commercially and economically usable in normal peacetime operations should be sold and the government's investment in them liquidated. Generally speaking, we are opposed to long term leases of plants by the government to private operators since such leases would in effect continue the government in business.

(3) Those facilities which are not commercially usable should be closed up and adequately protected so that they would be immediately available in the event of another emergency. Except in unusual instances, we do not favor scrapping

"Pete" Jones in Professorial Role, Explains the Transformation of the Transport System.

anything which may serve this country in time of need. We believe our chances of maintaining peace are directly in proportion to our ability to protect ourselves against wartime tendencies of other nations. The government can well afford to make such expenditures as are necessary to maintain in working order war plants and other facilities in the same manner as it maintains its Army and Navy.

(4) Sale of surplus facilities should be handled in such a manner as not to disrupt the normal functionings of the industry. If by placing government-owned properties in private hands, existing industry facilities would be displaced and abandoned, we feel it would be better for the economy of the country for the government to hold such facilities in idle reserve.

(5) Facilities should not be sold on a basis which would give purchasers unfair competitive advantages. The government is in a very disadvantageous trading position in selling a surplus plant adjacent to a private plant and of use only to the operator of the private plant. Rather than demoralize the industry's operations by selling at less than the value to the purchaser, thereby vesting in such purchaser a competitive advantage, the government could better spend additional sums for holding such properties inactive until needed.

(6) Believing as we do that competition is the life blood of free enterprise, no sales should be made which tend to create monopolies. For example, if utilized at all for oil transportation, government pipe lines must operate as common carriers, available to all independents as well as to the major companies.

(7) Finally, in the discussion of policy, it should be kept in mind that for the most part these government-built plants and facilities have served their purpose. They are, in a sense, expendables. Other implements of warfare on battlefronts and in storerooms became obsolete on Armistice Day. War is waste. We disregard this in the heat of conflict. Being human, when the ordeal is over and the danger passed, we try to salvage, to reclaim waste. This is right and proper, but perspective should be preserved. We should not lose sight of the larger peacetime objective, a greater national income, productive work for anyone who wants it, the nation's solvency preserved. It is possible that after spending 300 billions to insure free enterprise, we may, in an effort to save a few millions at the spigot, lose the greater objective.

Accompanying this statement of principles was a brief outline of the wartime revolution in oil transportation and the changes which it included which were graphically portrayed through a series of 19 charts. This, in turn, was followed by detailed reports relating to pipe lines, refineries and tankers built at the government expense to serve special military needs.

Because of the discussions that had taken place in Congress and in the press regarding the war emergency pipe lines, more particularly the lines constituting the "Big Inch" systems, public interest centered largely in the special report relating to these lines and their possible post-war use. As the report points out they present a problem entirely different from that involved in the disposal of other transportation facilities because of their extremely large size and capacity. They were built solely for emergency use and, undoubtedly, shortened the war in Europe by transportating 300 million barrels of oil before V-E Day, at the same time paying for construction and operating costs and leaving a balance of over $156 million at the end of the war. The lines, therefore, have fulfilled the purpose for which they were built but their continued operation as oil carriers faces numerous obstacles such as their inability to compete effectively with tanker transportation, the difficulty of providing a sufficient supply of crude or products to keep them in full operation without displacing other established pipe line systems and the fact that they would not serve the peacetime needs of refiners as they did during the war when their deliveries were of uniform specifications for use of the armed forces. Economic studies indicate that post-war demands for petroleum will be 750,000 barrels daily below peak requirements of the war period and will not rise to that level for several years. Since the lines were built with the money of American taxpayers it would be manifestly unfair to use them to force out of business the facilities established at the expense of tax-paying citizens.

Because of their location the possible uses of the Big Inch lines are confined to the movement of crude or products from Texas to the Midwest or to two terminals on the East Coast. A detailed analysis of conditions in these areas is included in the report. It reveals that the tanker fleet of the United States, now aggregating over 13,000,000 tons, providing a carrying capacity much above Atlantic Coast requirements and that tankers, aside from their greater economy, are so much better adapted to meeting the requirements of refiners that they are greatly preferred by shippers. Refinery runs to the central states traversed by the Big Inch lines are calculated at 890,000 to 990,000 bbl. daily and are met to the extent about 40 percent from production within the area, leaving 590,000 to 620,000 bbl. to come from outside. Industry-owned pipe lines serving this region have a daily capacity of 633,000 bbl. which is supplemented by river transportation which in 1944 handled 67,000 bbl. daily. Thus there exists surplus capacity for the movement of crude to this area. The refining plant within this district is capable of supplying all but a small fraction of the demand for products while the industry-owned pipe and barge lines adapted to the movement of such products are capable of handling over 300,000 bbl. daily. No economic reason exists for the use of the Big Inch lines to serve this interior region and such use actually would displace an equal capacity of industry-owned refining or transportation equipment.

As the report points out the only pipe lines of such large size as those of the emergency system

heretofore built have been for the transportation of natural gas and it discusses their potential employment for this purpose. The feasibility of this conversion is summarized as depending on the ability to obtain gas at a fair profit to a market able and willing to consume, and on the further premise that the lines can be purchased at a reasonable cost. On the question of supply it is pointed out the deliverability of gas by the Big Inch lines over a period of 25 years would be of the order of 2.5 trillion cu. ft. which is less than two percent of present proved natural gas reserves. A large part of these reserves is within the area contiguous to the starting points of the emergency lines and an adequate price for the gas in the field should assure the availability of the required supply for the forseeable future. Answering the claim that the introduction of natural gas into the New York-Philadelphia area of the Atlantic Coast would dislocate the balanced utilization of the country's natural resources, specifically by cutting down the use of coal and diminishing railway revenues from its transportation, it is shown that upon the introduction of natural gas into urban areas the usual practice is to mix it with natural gas, thereby increasing its heating value with a resultant growth in demand. Essentially the operation includes the substitution of reformed natural gas for carburated water gas, the enrichment of coal and coke-oven gas with natural and the use of reformed natural gas for requirements not met by either of these procedures. If this course were followed there would be no change in the use of coal but there would be a saving of about ten million barrels of oil now used by the gas companies for purposes which would be replaced by natural gas. Preliminary study of the market indicates that the area immediately surrounding the eastern terminals of the emergency lines can easily absorb the capacity of the lines without materially affecting the use of either coal or electricity. Engineering problems involved in the conversion of the system to natural gas are capable of solution. Various changes in facilities would be required, including the installation of new gas compressor stations along the line. The report also suggests the advisability of an amendment of the natural gas act to define the position of the Federal Power Commission and confirm the authority of the states over the production and intrastate distribution of gas.

Summarizing its consideration of conditions applying to the Big Inch pipe lines the report makes the following recommendations:

(1) Because of their military value the Big Inch lines should not be scrapped.

(2) The lines should not be utilized in the post-war period for the transportation of crude oil or refined products either to the East Coast or the interior.

(3) Under certain conditions it would be feasible to convert the lines to natural gas service.

(4) In the event the lines are not converted to natural gas service it is recommended that they be removed from use by Congressional direction and held as a military asset.

Regarding other inland transportation facilities the report recommends that government owned pipe lines which serve no useful peacetime purpose can be scrapped and that other lines be offered for sale or if not so disposed of that the material be salvaged. The same policy is proposed for tugs, barges and tank trucks.

On the subject of tankers the report shows that since 1939 the United States fleet has been expanded by the addition of 535 ships aggregating 8,956,000 deadweight tons and that 244 ships representating 4,066,000 tons have been added to the world fleet. The problem in this field, therefore, is one of disposing of a large number of ships by sale either to American or foreign operators or by scrapping those that are actually or relatively obsolete and laying up others for possible future emergency use.

The following observations are presented:

"A study of the tanker position indicates that the American-flag tanker fleet far exceeds this nation's domestic commercial requirements. The foreign picture is the reverse, due principally to the heavy losses of tankers by enemy action and the inability to construct any appreciable amount of replacement tonnage abroad during the war. However, the tanker construction program of the United States government in this period has augmented the world tanker fleet to a point greatly in excess of its pre-war status. Consequently the question of the disposal of the surplus American-flag tankers has been receiving constant atention by government representatives, ship-owners, shipbuilders, exporters and others both here and abroad for some time.

"The performance by American-flag tankers in the sucessful prosecution of the war demonstrated beyond a doubt the importance of maintaining an adequate and efficient American-flag tanker fleet as a prerequisite for our nation's defense and economic security. This policy is one that all American-flag shipowners and operators endorse and is in conformity with the Merchant Marine Act of 1936, enacted for the purpose of fostering the development and encouraging the maintenance of a Merchant Marine owned and operated under the American flag by citizens of the United States; such fleet to be constructed in the United States composed of the best equipped, safest and most suitable types of vessels.

"Consistent with this spirit and in spite of future uncertainties, a number of American tanker owners took the initiative and have already purchased war-built tankers. However to stimulate further purchases it would seem necessary for the government to adopt promptly a constructive policy for the disposal of the remaining surplus. At the present time about 82 percent of privately owned tankers operated under the American flag are owned by oil companies, the remaining 18 percent being owned by others not in the oil business. Under normal conditions oil companies operate their tankers in the transportation of their own products, augmenting their fleets by chartering the vessels owned by non-oil companies under long-term freight contracts or periodic charters. Tankers, therefore are a major link in the transportation system of the petroleum industry and in order that the industry may best continue to serve the public efficiently, private ownership should be encouraged and the government should divest itself of government tankers as soon as possible to avoid competition with free enterprise.

Senator O'Mahoney Opens a Hearing of the Special Committee Investigating Petroleum Resources.

Special reports prepared by C. H. Kunze of Socony-Vacuum Oil Company and T. E. Buchanan of The Texas Company outline a policy for the sale of government owned tankers which includes a determination by the Army and Navy of the size of tanker fleet required for national defense and security, an offer to sell surplus tonnage first to American citizens and subsequently to foreign governments or non-citizens. Discouragement of the use of over-age vessels for commercial trade and the placing in a national reserve of other ships, these, however not to be held beyond possible usefulness.

A special report dealing with government ownership of refining facilities, prepared by a subcommittee of which Hines H. Baker, vice president of Humble Oil & Refining Company, was chairman, was included as part of the presentation. This report described at length the various processes employed and the resultant products for military use, information certain to be of particular value to the Senatorial investigators in reaching conclusions as to the disposal of this type of government property.

The report shows that the government's investment at or adjacent to petroleum refineries including projects under construction, now amounts to nearly $570,000,000, divided as follows: $238,000,000 for high octane facilities; $48,300,000 for toluene, and $238,100,000 for butadiene and butyl rubber plants as part of the wartime synthetic rubber program.

Most of the government installations for the production of high octane gasoline and its components were built as units of privately owned refineries or are closely connected with such plants. In disposing of these properties the obviously logical course would be to sell or lease these to the owners of the connected plants in cases where they are in a position to use the facilities and to salvage the materials in other cases.

Plants constructed as part of the synthetic rubber program are in a class by themselves. Although most of these are closely connected with general refining plants they were built with government funds because they were established for purely military production and were considered to face an uncertain post-war future depending upon the success attending the manufacture of the synthetic product and the policy adopted by the government toward the industry.

As general principles to govern the disposal of government owned refining installations the committee suggests the following:

(a) Existing contracts entered into by agencies of government and present operators of government-owned property should be respected.

(b) Subject to observance of the terms of existing contracts, government should divest itself of ownership of all types of refining and related facilities as soon as feasible and practicable. Except in unusual and exceptional cases, leases should be of short duration and limited to periods while purchase negotiations are under way.

(c) The disposition of government-owned facilities should be handled in such manner as to avoid serious disturbances to competitive investments of private enterprise.

(d) No purchaser or lessee of any government-owned facility should receive preferential treatment in the purchase of goods directly or indirectly by government by reason of purchase or lease of a government-owned facility. This is essential if competitive conditions are to be maintained in the industry and the government is to make its purchases on advantageous terms.

In regard to plants built for the production of materials for synthetic rubber the report makes the following observations:

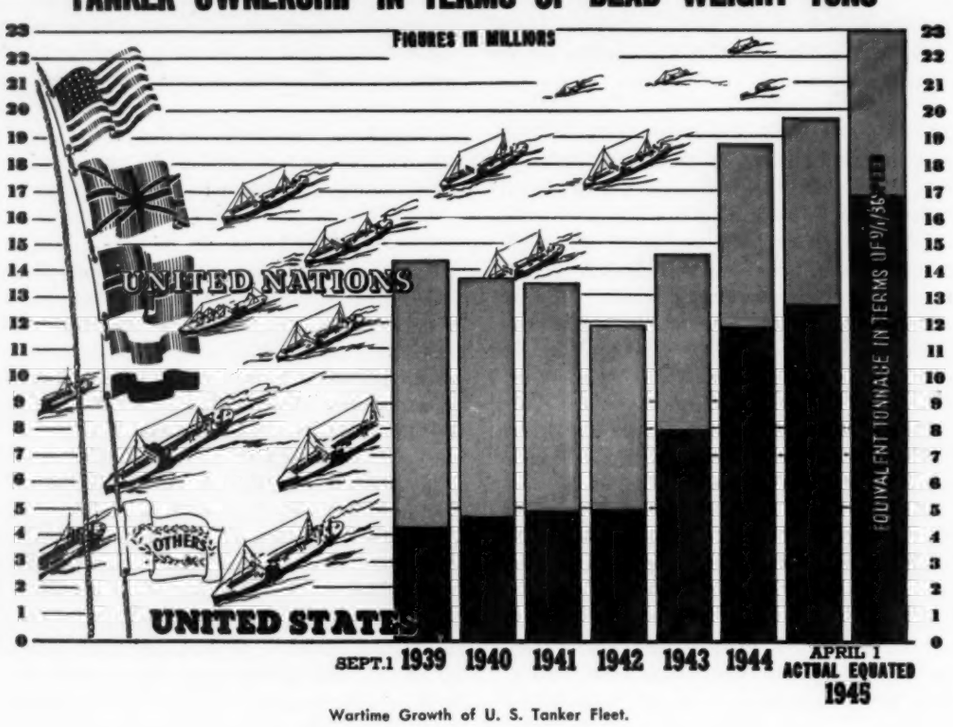
"Due to anticipated domestic and export demand upon the United States during the immediate future for tires, tubes, and other rubber products, it seems probable that all of the low cost, and perhaps all of the high cost, synthetic rubber plants must continue to operate for a period of from one to three years. The wide difference in cost of butadiene produced from alcohol and from petroleum, lack of knowledge of the condition of Far Eastern rubber plantations, and uncertainty regarding future international agreements seem to favor that government continue to carry on its synthetic rubber activities until the urgent demands have been met and until the position of synthetic rubber in commerce is more clearly defined. While the formulation of a policy for the disposal of such properties may be delayed for the foregoing reasons, it is suggested that in general the principles set forth above and the procedures outlined as applicable to other types of facilities also be observed in disposing of synthetic rubber plants when sold."

Toluene plants occupy an intermediate position between general refining facilities and those employed in the production of materials for synthetic rubber. The report suggests that where the facilities require substantial modifications in order to make them usable in place, that fact needs to be taken into account in the sale price. Where the facilities cannot be used in place or modified for use in place, they should be sold as a whole or in component parts for the highest cash price obtainable by competitive bids.

The report points out that refining units installed for the production of 100 octane gasoline include three classes of property: facilities not suited in place for the production of peacetime products; facilities that by extensive modification can be converted in place to useful postwar purposes; and units that have a definite and attractive place in normal refining operations.

Those in the first category, unless they can be converted to some useful purpose, should be sold for their salvage value. Disposition of those in the second class should be discussed with their present operators and their value after conversion be determined as competitive bidding for such properties does not appear to be practicable. Units of the third classification might be advantageously sold to the owners of the adjacent facilities who could use them in their peacetime refining operations. Leases of government owned facilities for the interim periods may be necessary but in general outright sale is recommended in order to divorce the government completely from participation in the petroleum industry.

Senator Moore Studies the Changes in Tanker Movement as Mr. Jones Illustrates Them.


TANKER OWNERSHIP IN TERMS OF DEAD WEIGHT TONS
FIGURES IN MILLIONS
UNITED NATIONS
OTHERS
UNITED STATES
EQUIVALENT TONNAGE IN TERMS OF 9½/56
SEPT.1 1939 1940 1941 1942 1943 1944 APRIL 1 ACTUAL EQUATED 1945

Wartime Growth of U. S. Tanker Fleet.

An exception to the recommendation against continued government ownership is noted applying to synthetic rubber facilities. On this subject the report observes:

"Plants producing butadiene from petroleum for synthetic rubber are not easily adaptable for use in the production of ordinary civilian petroleum products, and their adaptation to other than the manufacture of butadiene may be said to be limited to the usefulness of component parts. Informed persons seem to be in general agreement that substantial quantities of synthetic rubber will be required for at least two or three years because of the anticipated heavy domestic and export demands upon the United States and the present uncertainty concerning the condition of rubber plantations in the Far East. The cost of butadiene manufactured from butylenes and butane is at present far below the cost of butadiene made from alcohol and its substantially lower than butadiene made from raphtha by thermal cracking facilities, which, under pressure of wartime demands, were converted to such use. The lower cost plants manufacturing butadiene from petroleum, all owned by the government, nine in number, have a total rated capacity of 350,000 tons per year, or 51 percent of all butadiene plants including those plants producing butadiene from alcohol. In the absence of a greatly reduced price for alcohol, it is apparent that the nine lower cost plants producing butadiene from petroleum will be in the best position to compete with natural rubber. The ability of synthetic rubber to compete with natural rubber depends upon the extent of improvement in operating techniques, cost of production, international trade relations, and other factors not at this time determinable. The average price paid for natural rubber during the five-year period ending December 31, 1941, is higher than anticipated postwar cost of synthetic rubber manufactured from butadiene produced at the lower cost plants."

Taken together the series of reports submitted by the industry committee provides a full factual presentation of the extent and use of government owned petroleum facilities and provides a basis for the disposal of these properties in such manner as to assure a minimum of economic disturbance and the maximum return to the federal treasury. Through performance of its monumental task the committee has rendered a public service of the first order both to the nation and to the industry.

Subcommittee On Pipe Lines
B. I. Graves, Chairman

*P. R. Applegate	*Gavin W. Laurie
Paul G. Blazer	C. R. Musgrave
E. Buddrus	*J. A. Neath
A. L. Christy	*S. F. Niness
Fayette B. Dow	*E. Holley Poe
W. R. Finney	J. French Robinson
*J. W. Hershey	Sidney A. Swensrud
Clark H. Kountz	T. E. Swigart
*J. L. Latimer	

*Associate Members

Subcommittee On Refineries
Hines H. Baker, Chairman

Robert H. Colley	John W. Newton
Jake L. Hamon	M. H. Robineau
C. S. Jones	G. L. Rowsey
W. L. Stewart, Jr.	

Subcommittee On Tankers
W. S. S. Rodgers, Chairman

O. D. Donnell	C. H. Kunze
Orville Harden	J. R. Parten
J. Howard Pew	

Committee On Post-War Disposal Of Pipe Lines, Refineries And Tankers
W. Alton Jones, Chairman
President, Cities Service Company

Hines H. Baker, Executive Vice Pres. Humble Oil & Ref. Co.	Paul G. Blazer, Chairman of the Board Ashland Oil & Ref. Co.
E. Buddrus, Pres. Ind. Natural Gas Assn. of America	A. L. Christy, Transportation Div. Pure Oil Company
Robert H. Colley, President Atlantic Refining Co.	O. D. Donnell, President Ohio Oil Company
Fayette B. Dow, Attorney Nat. Petroleum Ass'n.	W. R. Finney, Pipeline Advisor Standard Oil (N. J.)
B. I. Graves, Vice President Tide Water Assoc. Co.	Jake L. Hamon, Partner Cox and Hamon
Orville Harden, Vice President Standard Oil (N. J.)	C. S. Jones, President Richfield Oil Corp.
Clark H. Kountz, Vice President Sinclair Refining Co.	C. H. Kunze, General Manager Marine Trans. Dept. Socony-Vacuum Co.
C. R. Musgrave, Vice President Phillips Petroleum	John W. Newton Vice President Magnolia Petroleum
J. R. Parten, President Woodley Petroleum	J. Howard Pew, President Sun Oil Company
M. H. Robineau, President Frontier Refining Co.	J. French Robinson President American Gas Assn.
W. S. S. Rodgers, Chairman of the Board The Texas Company	G. L. Rowsey President Taylor Refining Co.
W. L. Stewart, Jr. Executive Vice Pres. Union Oil Co.	Sidney A. Swensrud, Vice President Standard Oil (Ohio)

T. E. Swigart,
President
Shell Pipe Line
Corporation

A Catalytic Cracker for Small Refiners

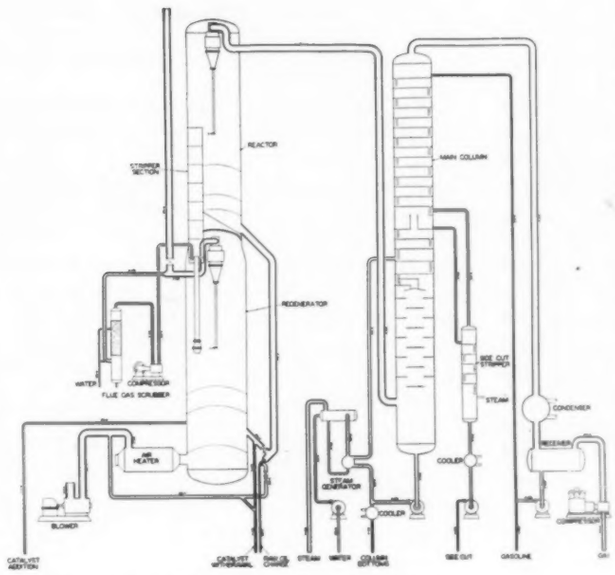
THE Universal Oil Products Company has modified the design of catalytic cracking units to meet the needs of the smaller refiner. This simplified design, the MS-Type Catalytic Cracking Unit, has the outstanding feature of low investment and low operating costs, plus improved processing efficiency.

The operating costs per bbl. of charge compare favorably with two-coil thermal cracking units of comparable charge capacity. The cost estimates are based on receiving a gas oil feed and cover the entire operation of the unit through absorption, debutanization of the catalytically cracked gasoline and recovery of a liquid feed for polymerization. The catalytically cracked gasoline can be finished in most cases with no treatment other than caustic wash and the addition of an inhibitor.

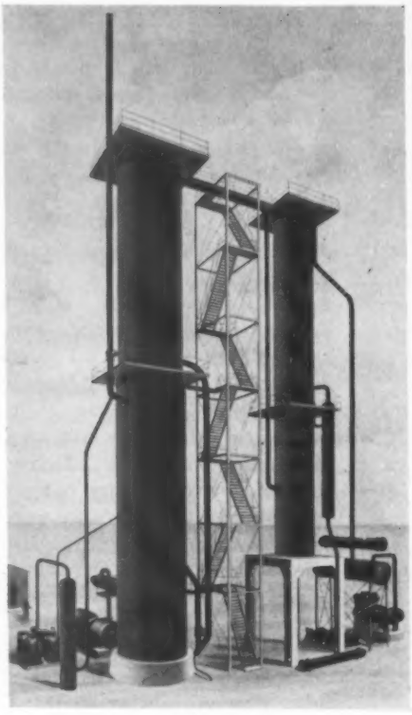
The most simple design of the MS-Type unit is based on the use of a synthetic catalyst having a microspherical form. However, a catalyst in the powdered form, either synthetic or natural, can be used with certain additions to the plant. Two synthetic MS-Type catalysts, silica-alumina and silica-magnesia, are available. Silica-alumina catalyst would be used if maximum octane rating is the primary consideration. The gasoline yield with silica-magnesia catalyst is substantially higher but the octane rating is lower. Because of the lower cost per pound of the natural catalyst its use should also be considered. The natural catalyst gives a gasoline yield and octane rating intermediate to the values obtained with the synthetic catalysts but with a higher coke production and catalyst replacement rate. Economic considerations of market requirements and operating costs will govern the choice of catalyst. Typical yields and product qualities are shown in the accompanying table.

UOP MS-Type Catalytic Cracking Processing Mid-Continent Gas Oil Once-Through Operation At 65% Conversion

Catalyst:	Silica-Magnesia	Natural	Silica-Alumina
Yields, Vol. %			
Debutanized 400°F. EP Gasoline	53.0	48.9	45.5
Cycle Stock, 400°F.+	35.0	35.0	35.0
Butylenes	5.5	5.8	6.2
Butanes	5.5	7.4	10.9
Propylene	3.8	4.8	6.8
Propane	1.9	3.4	3.7
C_2 & Lighter Gas, Wt. %	1.9	1.7	1.7
Debutanized 400°F. E P Gasoline (5-6# R. V. P.)			
Octane No. ASTM (F-2)			
Clear	79.1	80.3	82.1
+ 3 cc. TEL	85.2	86.5	87.7
Octane No. Research (F-1)			
Clear	89.0	90.8	93.0
+ 3 cc. TEL	95.4	96.5	98.7
Cycle Stock, 400°F. + Gravity, °API	26	26	26
C_4 and Lighter Gas Molecular Weight	12	12	14
Heating Value, BTU/Cu. Ft.	740	740	840



Cross Section of the U.O.P. MS-Type of Catalytic Cracking Installation.



Perspective View.

NOTE:—The catalytically cracked gasolines have blending octanes considerably higher than the straight octanes when blended with straight run gasolines. This blending value varies with the quality of the straight run and the percent of cat cracked gasoline in the blend. For example, 30% cat cracked gasoline blended with straight having a 53 octane rating shows a blending octane of 89 ASTM (F-2) and 110 Research (F-1).

As an illustration of the flexibility of this form of the fluid-type catalytic process, commercial units have been operated with reactor temperatures ranging from as low as 800°F. to as high as 1000F. Stocks processed commercially have ranged from gasolines to topped crude fed directly to the catalyst section without preflashing. Various recycling operations and combinations of catalytic and thermal cracking operations have been investigated. The inherent flexibility of the fluid catalyst cracking unit plus the economies of the MS-Type design combined to make this unit entirely practical for the smaller refiner who is faced with the problem of increasing the octane rating of his motor gasoline.

Briefly, the flow through the unit is as follows: The oil feed is charged as a liquid at the base of the reactor riser; hot catalyst from the regenerator enters the riser at the point of oil injection, supplies the process heat requirements and is transported upward by the vaporized oil into the reactor.

Spent catalyst is continuously withdrawn from the upper part of the reactor dense phase to hold the level in the reactor and passes downward through the stripping section into the regenerator. Inert gas, prepared by water scrubbing a small portion of the flue gas, is used for stripping.

Catalyst passes downward through the regenerator counter-current to the air supplied at the bottom for regeneration. Additional stripping of the spent catalyst is obtained in the upper section of the regenerator where the bulk of the flue gas from the combustion of coke in the lower sections contacts the incoming catalyst.

Regenerated catalyst flows from the lower section of the regenerator into the reactor riser at a rate controlled to maintain a constant reactor temperature. The regenerator flue gas is vented to the atmosphere through an internally mounted cyclone separator which recovers entrained catalyst and returns it to the regenerator dense phase.

The reaction products pass into the fractionator vapor line through an internally mounted cyclone separator which recovers entrained catalyst and returns it to the reactor dense phase. The vapors enter a fractionating column where column bottoms, a side-cut stream, gasoline and gas are prepared in the customary manner. Heat is recovered by circulating column bottoms through a steam generator and returning the oil stream to the fractionator at an intermediate point. Facilities for stabilizing the gasoline and preparing polymerization feed have been provided.

Oil Titles in Latin America

By H. V. B. Tompkins

A great deal of data has been published with respect to oil exploration and exploitation in Latin America but little has been brought out on the title or right under which exploration and exploitation are carried on. This is a fundamental. The right to explore and subsequently to exploit oil resources is the most important factor involved, though in many cases the conditions and limitations affecting it are not fully understood. In view of the many interests now planning to engage in operating in the countries south of the Rio Grande, it seems worthwhile to set forth some fundamentals with respect to the title repeating some details that are known to many of us.

As a preliminary, let us look briefly at the title situation in the United States. Title to the oil in the ground, in the majority of cases, is acquired by obtaining the landowners' title, the exceptions being where navigable rivers, lakes or riparian rights along the sea are involved in which cases title is obtained from the individual states or the federal government. In some western states the federal government has extensive holdings. In Texas a large amount of land is owned by the state.

This fee simple title is well understood. It covers ownership of everything on the surface, beneath the surface and above the surface. This title emanates from the Magna Charta of Old King John of England wherein the phrase "fee simple" originated. This system of ownership remains unaltered with few exceptions, one being in Louisiana where certain phases of the old Napoleon code apply, a relic of the time when Louisiana was a French colony.

In the countries south of the United States, however, the situation is entirely different. There is no "fee simple" title. In all these countries with the exception of the British, French and Dutch possessions, titles emanate from the old Roman code.

The Roman code prescribed that title to everything but the surface of the land was vested in the Emperor. All subsoil deposits of every nature were the property of Caesar. In the countries conquered by Spain this code was interpreted to leave with the Crown, ownership of all subsoil deposits of every nature. Subsequently, in 1672 and 1673, King Carlos and King Philip issued decrees transferring all title to such subsoil deposits to the nation.

When the Spanish colonies became independent nations, they preserved this method of ownership. In all these countries with the exception of Mexico, Colombia and Panama, the nation owns subsoil deposits practically without exception.

There may be some question of the practicability or advisability of a nation developing its own natural resources by direct government action. But in the countries of Latin America there is no question as to the legal right to do so or to their legal right to make any contract they may see fit to make and with respect to the development of their resources. This point must be clearly understood.

Contracts for the exploration or exploitation of oil in these countries vary as to form and procedure. Some are unilateral concessions, some are bilateral contracts but fundamentally they are uniform in one definite particular. No concession or contract gives the holder thereof any title to the oil in place in the subsoil. They give the right to explore for and exploit it if discovered but the title thereto always remains in the nation until the oil is actually produced. When produced the operator has title to the oil less government participation in the form of royalty, and only then. The operator has only the right to produce the oil and no title thereto until it is actually produced. This in not the case in the United States where one can get title to "oil in place" or as in Texas, the right to "reduce to possession".

The petroleum laws in the various countries of Latin America are in general workable and permit operation with security as has been demonstrated in many of them as for instance in Venezuela. In general, the petroleum laws of these countries emanate from parent mining laws. Certain rights and obligations contained in the latter are often incorporated in petroleum concessions and contracts. In some countries, for instance Nicaragua and Paraguay, special contracts covering large areas have been executed which are in a measure, laws themselves duly executed and containing provisions legal but which were not provided for in existing legislation. As a rule the various governments grant in the concessions or the contracts the right to use, free of cost, the surface of nationally owned land and to utilize without cost, any timber or water thereon. In addition, it is common practice to grant the right of condemnation to cover surface use of privately owned land.

The title situation in Mexico has been complicated and controversial and in a measure still is. Prior to 1886 title to all subsoil deposits of every nature was vested in the nation. In that year certain large landowners in the State of Coahuila, desiring to obtain titles to coal deposits, discovered under their properties, caused an act of Congress to be passed wherein all title to subsoil deposits of "carboniferous and petroliferous" substances was vested in the owner of the surface. This law was subsequently modified by laws and decrees during the years and up to 1909 but without altering the fundamental premise of ownership.

When oil operations commenced in the country this premise of ownership of the oil in the subsoil was used as the basis for acquiring title to oil deposits, oil being "petroliferous". Here it should be stated that the title was the title to the "oil in place". Title to oil in the subsoil was obtained by contracts executed with the surface owner, either in the form of leases or by purchasing the fee title. This method of acquiring title obtained without undue controversy until the promulgation of the Constitution of May 1, 1917. This was not a satisfactory method of obtaining title to the oil because titles practically without exception, were faulty. In many cases they did not exist. In every state with the exception of San Luis Potosi it was necessary to have a hundred percent title in order to have any right in contrast to the prevailing rule in the United States where obtaining title from a majority of the owners' permits one to operate, placing royalties in escrow. In San Luis Potosi 67⅔ percent title gives one the right to operate. This gave rise to many difficulties; large expenditures and long periods of time were required to clear these titles; Some never were perfected.

The Constitution of May 1, 1917 in Article 27 stated "In the nation is vested direct ownership etc." This caused considerable discussion with respect to whether the adoption would be applied retroactively. There was no question of the new constitution being able to abrogate previous acts of Congress. The only question was one of retroactivity.

In August 1923, the "Warren and Payne" agreement was effected. This evolved the principle of "Tagging", the creation of the principle of the "Positive Act", the principle of proving that some positive act had been committed prior to May 1, 1917. These principles were evolved to a solution of the question of retroactivity. Positive acts were liberally interpreted. Exhibition of an oil lease contract with the surface owner executed prior to May 1, 1917, exhibition of a deed to the surface of the land wherein it could be evidenced that the acquisition thereof was for the purpose of developing oil thereunder or exhibition of even sketchy geological reports purporting to show that geological work had been

done upon the land prior to May 1, 1917, were sufficient to "tag" the land, to prove that a "positive act" had been committed and the ownership by the government was waived, annuled.

On December 26, 1925, a petroleum law was passed regulating Article 27 of the Constitution of May 1, 1917 and subsequently articles regulatory thereto were worked out by the government officials in conjunction with representatives of the oil industry. This law was supplemented with respect to the confirmation of their properties by the law of January 3, 1928.

These laws recognized properties "tagged", on which a "positive act" had been committed prior to May 1, 1917 . They became known as "preconstitutional" properties. These laws and the regulations thereof promulgated the method by "confirmatory concessions" would be issued. It is of importance to note here that the question of proving title to the surface of the land was not and is not the issue. The matter of furnishing proof of the "positive act" is the point involved. The effectuating of the "positive act" to repeat, vested the title to the oil in the subsoil in the owner of the surface and divested the nation of any title thereto. It became a "preconstitutional" property confirmed by the issuance of a "confirmatory concession."

On March 18, 1938 the expropriation of the oil industry in Mexico by the Mexican government took place. Since that date no foreign oil interests have operated in Mexico.

On May 2, 1941 a new petroleum law was passed materially changing the law of December 1925 but preserving the recognition of preconstitutional rights. However, no drilling permits have been granted to the owners of preconstitutional confirmatory concessions to date with the exception of certain Mexican nationals in North Mexico where they have drilled for and developed some commercial gas wells. These drilling permits come under the government "police regulations". Permits have not been actually refused in all cases but they have not been granted when applied for and, of course, land is of no value for oil unless one can obtain permission to drill it.

In Colombia, where the land was acquired previous to 1873, the owner thereof has title to the oil in the subsoil. However the government requires a royalty from oil produced therefrom. Furthermore, the government requires that the private title to the land, that is the surface, be proven to the satisfaction of its judicial branch. This has been difficult to do as many surface-owner's titles are extremely defective. In the basin of the Magdalena River where some of the best prospects for oil are believed to be, at least where the land is accessible, there are many large land holdings. Failure to prove title to large areas of this land has seriously retarded the development of the oil resources of the country. The government now is cognizant of the situation and new legislation is in process of being promulgated. One proposed law now drafted is expected to be submitted to Congress which will improve this situation. I have studied this proposed new law with respect to its provisions having to do with privately owned land, properties "particular" and it has possibilities.

In Panama the situation with respect to lands where the surface was privately owned prior to 1873 is the same as that in Colombia because at that time and previous thereto Panama was a part of Colombia.

The countries of Central America in general have mining and petroleum laws not unfavorably constituted but in many cases incomplete and consisting of a series of laws and decrees issued from time to time. Outside of Guatamala and Nicaragua there has been little oil activity of recent years; hence, the existing legislation has not been particularly proven as to its being favorable or unfavorable. It can be said however that as a whole these countries are favorably inclined to afford facilities to those desiring to enter into oil contracts or obtain concessions.

In Guatamala contracts favorable to oil development were in existence before World War II. During the war these were dropped for reasons of expediency. At the present time certain interests have workable contracts pending with the government. The government is disposed to offer facilities and where present legislation is not sufficiently comprehensive the situation is to be covered by special contracts which when approved officially will be entirely legal.

In Nicarauga two important oil companies jointly have a contract under which they are now doing exploratory work. This contract is rather comprehensive and covers practically all the known geologically favorable area in the country. In Panama certain interests are now working out a rather comprehensive contract.

In Colombia extensive operations, as is known, are being carried out. In the foregoing the situation with respect to properties "particular" has been dealt with. However, in analyzing the petroleum laws and decrees and the portions of the mining laws pertaining to or applying to petroleum, one is impressed with the fact that from and including 1919 to and including 1939 ten petroleum laws have been passed and five decrees thereon issued which are still pertinent in whole or in part. Some of them have been cancelled in part by subsequent laws and some of them subsequntly modified. The regular Law No. 37 of 1931 with its regulating decree 1270 is the present basis for concessions. However, this law refers back to former laws and decrees in their entirety or to parts thereof and has been modified by subsequent laws and decrees. All this requires a rather comprehensive knowledge of all these laws and decrees to properly comply with concession contracts.

As is well known Venezuela has a new petroleum law published March 13, 1943 with regulations thereon published in August 1943. These were compiled with the assistance of experts, some of them from the United States. This law will not be dealt with here as it is well known and favorably received by the companies operating there.

At the present time the Brazilian laws do not admit of the development of oil resources by foreign interests. The government is engagd in exploring and developing its own resources.

Formerly, foreign oil interests were permitted to acquire properties in Argentina. There are foreign oil interests still operating properties previously acquired. But no foreign oil interests are now permitted to acquire new or additional oil properties. The government petroleum organization is the only one permitted to engage in new exploration and exploitation.

The Chilian government is engaged in exploring the country for oil and has been doing considerable geological and geophysical work together with wildcat drilling, the policy being to develop what oil may exist in the country.

The Bolivian government some years ago acquired the foreign holdings in the country and is now engaged in developing the oil resources of the country as a government project.

The oil resources of Peru have been developed in the past by foreign interests. At present such possible oil territory as remains on the Pacific Coast is being held for development by government operations. In the interior, to the east of the Andes the Blue Goose, an American Company, has been operating, but this territory is so inaccessible that in the main it is not attractive.

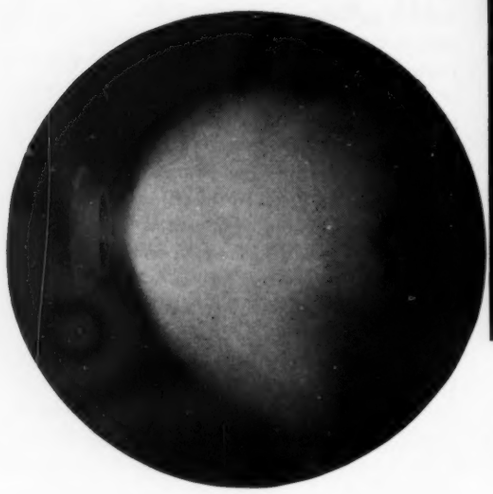
The favorable area of the Paraguayan Chaco, is now covered by a government contract with an American company. This contract has many favorable features and the company is now carrying on exploratory work under it.

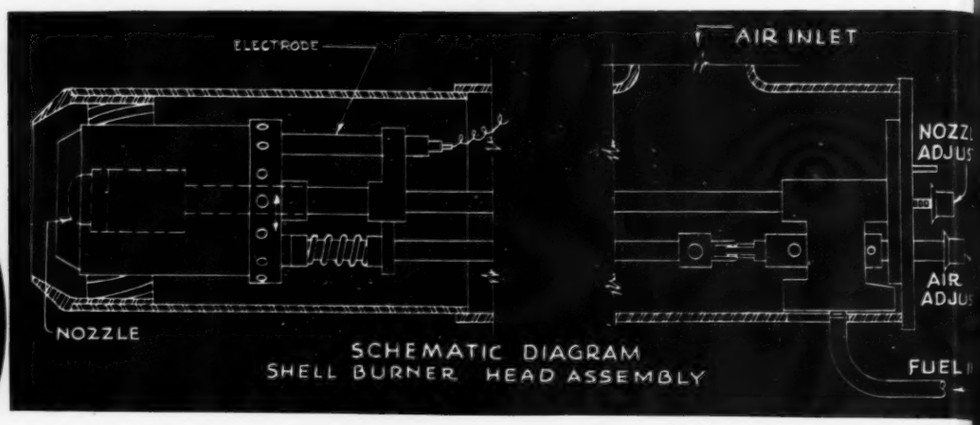
Ecuador has very favorable mining and petroleum laws. They are fair, clear and offer many facilities for development. As the result of the Petroleum Law 70 of October, 1937, exploratory work has been stimulated in the country.

To sum up, the countries in Latin America where the title situation admits of foreign interests operation and where at present foreign interests can acquire properties are the Central American countries including Panama, Colombia, Venezuela, Uruguay, Paraguay, Peru, Ecuador. The countries where at present the title situation or other considerations do not admit of foreign oil operations are Mexico, Brazil, Argentina, Chili, Bolivia.

As stated in the foregoing this is exclusive of British, French and Dutch possessions.

Side View of Shell Domestic Burner Head Showing Flame Retention.





"Cat" Cracking Growth Spurs Burner Research

Western Refiners Association, A.S.T.M., Burner Manufacturers and Oil Companies Seek Better Ways to Burn Aromatic Domestic Fuel Oils. Shell Develops New Head for Bayonet Type Burners

TWO estimates of the number of domestic oil burners which will be in service in central heating plants by the end of 1950 were made at the recent annual meeting of the American Petroleum Institute. W. A. Matheson, president of the Oil Heat Institute of America, estimated that there will be 4.5 million units five years hence. Arthur E. Pew, Jr., J. Bennett Hill and John R. Bates of Sun Oil Company, estimated the 1950 total at 3,739,910.

No matter who may prove to be the more accurate prophet it is clear that the oil industry will be called on for tremendously increased quantities of distillate fuel oils. Mr. Pew and associates have estimated that 1950 fuel consumption by domestic central heating oil burners will total 46.2 barrels per burner. On the same consumption factor the 4.5 million units forecast by Mr. Matheson would consume 207 million barrels of distillate fuel in 1950. Other oil industry economists have suggested an annual consumption of 50 barrels per burner in 1950, thus adding 18 million barrels to the fuel estimate.

The average oil burner is a far more important consumer of petroleum from a liquid volume standpoint than is the average passenger car. Where the passenger car may burn 14-16 barrels of petroleum per year the oil burner consumed an average of 54.88 barrels per season in the five years just before World War II. Even in the depression years 1931-35 the average was 46.16 barrels per burner and under wartime rationing the average was 45.25 barrels. Each heating plant in a home may be compared with about 3.2 passenger cars as a consumer of petroleum.

A profound effect on the refining industry may be anticipated in the next few years as a result of the shifting emphasis on product yields. Passenger car registrations are expected to increase 25 percent in the next five years while oil burners are increasing 47 to 75 percent.

As pointed out elsewhere in this issue Diesel engines are on the boom for railroad and automotive use as well as for stationary power plants. Development of aircraft turbines requiring a middle-cut fuel from the heart of the crude oil also may exert an appreciable influence on refinery product yields.

Three principal products are derived from the middle fraction of the crude. They are kerosene, home heating oils and light Diesel fuels. These may be separated by straight distillation from crude oil or from cracked oils produced in the gasoline cracking process. At present kerosene and Diesel fuel are largely straight run but it may not be possible to continue selling virgin oils for these purposes if demand expands too rapidly when compared with other fractions.

Until World War II a very large portion of the home heating oil was straight run material, or a mixture of thermally cracked and straight run oil. During the war the rapid growth of catalytic cracking made it necessary to include catalytically cracked materials in domestic fuels with the result that service calls on both burner dealer and oil distributor were multiplied.

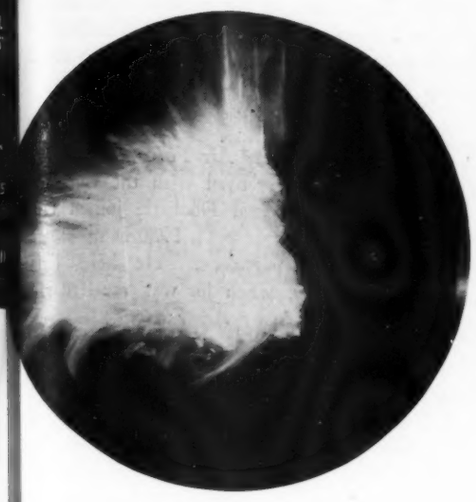
On January 1, 1942 there were only 14 catalytic cracking units with a capacity of 190,000 barrels daily in service. Now there are 96 units with a capacity of 1,070,000 barrels per stream day, Mr. Pew told the API. These units produce about 40 percent oils in the light distillate range when operating on light charging stocks. The yield decreases as the charge becomes heavier.

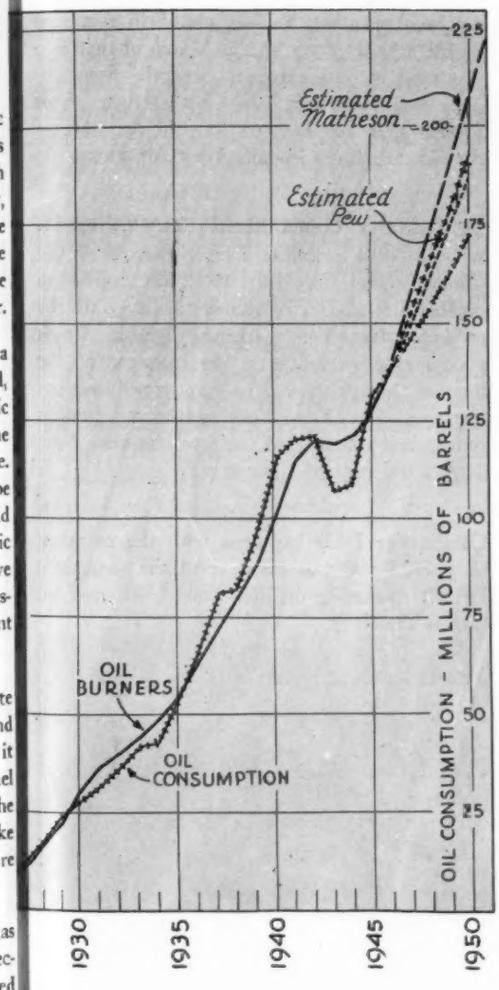
Assuming that gasoline demand will be for a high quality product in the post-war period, Mr. Pew suggested in his paper that catalytic crackers will be operated at a high rate. The demand for virgin charging stock will be active. A large part of the cracked distillate will be recycled to increase high octane gasoline yield and, as a result, the gravity of available domestic fuel oil will be lower. No. 2 fuel oil may have a gravity range of 28-30° API, 10 percent distillation at about 460° F. and a 90 percent point of about 585° F.

Recognizing that domestic fuel oil must compete with gasoline on one hand for raw material and with coal and gas on the other for a market it is obvious that large future increases in fuel demand will depend on proper utilization of the lower gravity completely cracked oils. To make this possible the oil and burner industries are studying the matter intensively.

The American Society for Testing Materials has been working on the problem through three sections of Commitee E. Section 1 has developed specifications for standard reference fuels which could be used by the various laboratories. These fuels have been under test by some 34 laboratories and these tests now are being summarized by Section 2. The report will be out within a month or so. Next step will be the formulation of tentative standard fuel oil specifications to re-

e View of Conventional Bayonet
ner Showing Ragged Flame
ical of Inefficient Combustion.





place the present U. S. Commercial Standards CS-12-40.

A companion research project carried on by the Oil Heat Institute has been the development of a standard reference burner so that laboratory results can be compared with assurance. Such a burner has been developed on paper and one is to be built soon.

Shortly before the API meeting the Western Petroleum Refiners Association announced results of its research program undertaken in July, 1944 to test burning qualities of various straight run, thermally and catalytically cracked fuels when used in pot type burners. The WPRA research conclusions were that cracked fuels show a greater tendency to smoke and form carbon than do straight run fuels. They are more sensitive to room draft, wind direction and fuel temperature charges which affect viscosity of the oil.

Sensitivity of pot type burners to cracked fuels is due to the higher percentage of aromatics which do not oxidize easily. Catalytically cracked fuels require a longer "soaking" time at the vaporization stage to provide thorough mixing with air before the oil is exposed to the higher heat from the combustion chamber.

Conclusions of the WPRA researchers were that pot type burners should be studied to achieve more satisfactory modifications and that some compromise is possible through mixing cracked fractions in with the straight run oils.

A few days after the close of the API meeting Shell Oil Company announced that its fuel research laboratories at Sewaren, N. J., had developed a new type combustion head for gun-type domestic burners which gives entirely satisfactory service burning 100 percent catalytically cracked fuel. The new burner head consists of a special arrangement of adjustable air cones, ports and vanes designed to obtain positive and accurate air control over a wide range of operating conditions. An accompanying drawing is a schematic sectional diagram showing how the air is directed to the exact point where it will mix with oil most thoroughly and the mechanical means used to obtain proper turbulence.

The new Shell burner head achieves, for bayonet type burners, the result recommended for the pot type burners by the WPRA researchers. Essentially it provides more air at the point where it will do the most good.

In the conventional burner it is possible to obtain good combustion of cracked fuels by supplying enough excess air to avoid smoke and soot formation. But this has the effect of increasing the heat up the stack. At the Shell oil burner research laboratories at Sewaren the researchers have given a great deal of attention to CO_2 content of flue gases and to smoke measurements. To test for smoke a sample is withdrawn from the flue and passed through a filter paper for a definite length of time. The paper then is compared with a scale ranging from 0 to 9 to determine sooting tendency; CO_2 content and temperature of stack gases are tested in the conventional manner.

Shell has found by many field studies that the average CO_2 content of stack gases in the field is around 7 percent. Eight percent is considered good and this represents only 72 percent burning efficiency in the furnace.

In a demonstration of the new burner head at the laboratory, tests were made showing 14.7 percent CO_2 in the flue gas and a stack temperature of only 410°F. Smoke test was 0.5 on the Shell scale. This was rated at 86 percent burning efficiency and a fuel saving of 21 percent over normal field conditions. With the new burner in the field an average of 12 percent CO_2 and burner efficiency of 84 percent has been achieved. The fuel saving in the field is on the order of 20 percent.

Shell is offering the new burner head to oil burner manufacturers for incorporation into their post-war models. The oil company does not propose to go into the burner manufacturing business to exploit the invention.

Another development at the same laboratories was a minor change in the height of grilles around flame rims of vertical rotary burners. With pre-war normal height grilles it was not possible to burn 100 percent catalytically cracked fuels without excessive smoke and soot. By raising the grilles two inches a much better air mixture was achieved and smoke rating was reduced from 4 to 0.5 on the Shell scale.

Other oil companies are undertaking similar research work on oil burner efficiency and on fuel oils. Most recent announcement is by Socony Vacuum Oil Company of a new unit installed at its Technical Service Laboratories in Brooklyn. At this plant instruments indicate the efficiency of the heating plant as regards the carbon dioxide content and temperature of flue gases, as well as the density of smoke, amount of draft and other factors involved in combustion. Dials not only show results of tests but a permanent record is produced by automatic pen prints on charts, so that continuous attendance is unnecessary to determine complete and accurate results over any given period of time.

Actual conditions encountered in operating burners may be duplicated in the laboratory or conditions may be simulated to ascertain what would occur if certain factors were introduced.

By these means Socony-Vacuum's engineers hope to prevent difficulties and offset problems which could conceivably arise. Control of the various factors involved in burning enables the engineers to test out theories for improved heating.

The apparatus, Socony-Vacuum technicians observe, also makes it possible to study methods of installation, design in construction of burner and their components, making it especially suitable for training combustion engineers.

Oil Company Staff Changes

David V. Stroop

DAVID V. STROOP has been appointed as assistant to the president of the American Petroleum Institute it was announced by president William R. Boyd, Jr. The new office was created by the board of directors of the Institute at the recent Twenty-Fifth Annual Meeting.

Mr. Stroop joined the API staff on February 1, 1928, as staff engineer. Subsequently, he became director of the department of engineering, and in 1933 he was also appointed secretary of the Institute's division of marketing. In 1942 his duties were increased when he was appointed director of the department of accident prevention, and again during the past year when he has served also as secretary of the division of refining. During the three years of war he was also the executive secretary of Petroleum Industry War Council's Commitee on Protection of Petroleum Facilities. His work in these several fields has given him broad experience in Institute affairs.

W. F. CLINGER of Warren, Pa., has been elected president of the Pennsylvania Grade Crude Oil Association, Oil City, Pa. He succeeds D. T. Andrus of Bradford, Pa., president since 1943. Mr. Clinger previously headed the association as president from 1937 to 1940.

B. T. Haskins of Wellsville, N. Y. was chosen first vice president to succeed A. C. Simmons of Bradford. D. T. Ring of Columbus, Ohio was reelected vice president.

Mr. Clinger is familiar with the problems of both the producing and refining division of the Pennsylvania Grade Crude Oil industry. He is head of the producing firm of Clinger Oil and Gas Company and is vice president and treasurer of Superior Oil Works. He has been a member of the association's advertising committee.

Miller W. Conn

MILLER W. CONN has resumed his duties as manager of the Perco Division, Chemical Products Department, Phillips Petroleum Company, Bartlesville, Oklahoma, following 2½ years service as Lieutenant in the Naval Air Forces. He has seen service in four continental naval air stations and for eleven months was attached to the Air Forces, U. S. Atlantic Fleet, Trinidad, B. W. I.

A. E. Buell, who has been serving as acting manager of the Perco Division during Mr. Conn's absence, will again devote all of his attention to his responsibility as manager of the special products division.

LIEUTENANT GENERAL JAMES H. DOOLITTLE, former commander of the 8th Air Force, rejoined Shell on January 1, as vice-president of Shell Union Oil Corporation, and will be a nominee for the Board of Directors at the next stockholders' meeting. He will make headquarters in New York, where his duties, in addition to general corporate responsibilities, will include coordination of the aviation interests of the Shell companies in the U. S. and assistance in the world-wide aviation activities of the Shell group of associated companies.

A member of the Army Air Force from 1917 until 1930, when he retired with the rank of First Lieutenant, General Doolittle joined the Shell Company on January 15, 1930 as manager of the aviation department. He held this position until 1940, when he was recalled to active duty in the Army Air Force.

As a Lieutenant Colonel he led the famous raid over Tokyo in April, 1942, taking off from a secret base which was later indentified as the aircraft carrier "Hornet". He was immediately promoted to Brigadier General, and later that year was raised to the rank of Major General. In January, 1944, he was placed in command of the 8th Air Force and in March of that year promoted to to Lieutenant General. Since the Japanese surrender and his return from Okinawa, he has been on duty in the office of the Commanding General, Army Air Forces.

LIEUTENANT COMMANDER SELWYN EDDY, who has been on military leave from Shell Oil Company, Inc., since July, 1942, has returned to civilian life and will become manager of the company's New York marketing division. Ralph Carey, who served as acting manager of the division during the war, has been named assistant manager. The New York marketing division comprises the New York metropolitan area, New Jersey, and part of Connecticut.

Commander Eddy has been with the company since 1925 and was manager of the company's Detroit marketing division from 1940 until he entered the Navy.

W. F. Clinger

Lieut. Comdr. Selwyn Eddy

THOMAS S. JOHNSTON formerly associated with the Standard Oil Company (N. J.) at New York, has been appointed manager of the marine departments of Imperial Oil, Limited, and International Petroleum Company, Ltd. at Toronto, Canada. He succeeds H. J. Rahlves, who is retiring from active service.

A native of Sarnia, Ontario, Mr. Johnston was first employed by Standard in 1928. In 1936, he became head of the dispatch and demurrage unit of the marine operating division and on January 1, 1941, was transferred to the Lago Oil & Transport Company, Ltd., at Aruba, N. W. I. as assistant manager of the marine department. After serving at Aruba for a year, Mr. Johnston returned to the United States and was appointed special assistant to the manager of Standard Vacuum Oil Company's marine department, a post which he held until October. 1944. At that time he was transferred to Imperial Oil, Limited, at Toronto, and became assistant manager of the marine department.

Mr. Rahlves is a widely traveled and internationally-known marine figure. In 1929 he was a member of a special committee to select a pipeline route and Mediterranean terminal for the Iraq Petroleum Company. The location and general layout of the bulk oil terminals at Haifa in Palestine and Tripoli in Syria are those proposed by him. He joined the Standard Oil in 1920 and a year later came to Imperial Oil, Limited, as assistant manager of the marine department, becoming manager in 1933.

The outbreak of war found Mr. Rahlves in charge of Canada's only seagoing tanker fleet, as well as a fleet of fourteen Canadian lake vessels and many other ships in South American coastal service. During the war his department was also responsible for operating twelve seagoing tankers built by the Canadian Government.

A. A. MacKrille

C. B. Singleton

C. B. SINGLETON has retired as national sales manager of the Shell Oil Company according to an announcement by P. E. Lakin, vice president in charge of marketing, New York. He will be succeeded by A. A. MacKrille, recently a Commander in the Navy and assistant manager of Shell's national sales department before his entry into the service in 1942.

Mr. Singleton has spent 32 years with the Shell organization. He handled purchases of materials and supplies for many years as manager of the company's purchasing department, a position which he held until 1941, when he was made manager of national sales with headquarters in New York. In 1941 he went to Washington to establish an office to work with government agencies on production and other war matters.

Mr. MacKrille, who succeeds Mr. Singleton, just returned from the Navy in Washington where he served as Commander in the Bureau of Supplies & Accounts, Purchasing Division, during the war. He joined Shell in 1930 and held a number of sales department positions during the next ten years.

DR. A. G. LOOMIS has joined the firm of Keplinger and Wanenmacher, petroleum engineers, at Berkeley, California. During the past ten years Dr. Loomis has been in charge of production and drilling research for Shell Development Company. Prior to that he did similar work for Gulf Oil Corporation.

JAMES E. PEW has been appointed manager of a new natural gas and natural gasoline division of Sun Oil Company. The new division will function as a part of the company's production department. Charles E. Webber was named by Mr. Pew as his assistant. Their headquarters will be in Philadelphia.

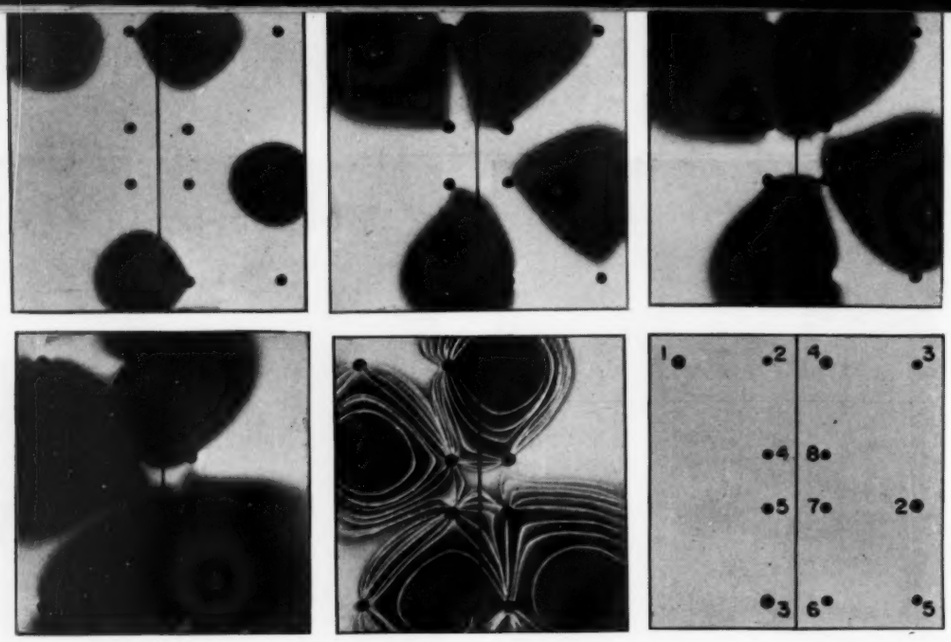
Mr. Pew, formerly superintendent of the Virginian Gasoline and Oil Company, Charlestown, W. Va., served 45 months with the PAW as director of the Natural Gas and Natural Gasoline Division. He is the son of John G. Pew, president of Sun Shipbuilding & Dry Dock Company, Chester, Pa., since 1918.

During the last two years of Mr. Pew's service with the PAW he was instrumental in helping to triple the country's production of natural gasoline and related products, which were used in large quantities in synthetic rubber, aviation gasoline, and chemicals. Earlier this year he received the Hanlon award for outstanding, meritorius service to the natural gas and condenstate industries.

Mr. Webber was assistant director of the PAW Natural Gas and Natural Gasoline Division at the time of his new appointment. Prior to his service with the government, he was a chemical engineer with Humble Oil Refining Company in Houston, Texas.

(*Continued on page 76*)

James E. Pew, Right and Charles E. Webber, Left, Direct New Sun Oil Company Natural Gas and Natural Gasoline Division.



Left: The three top photos and the one in lower left corner show the progressive spread of water from injection wells toward the producing wells, represented by black dots. Note that water does not reach all producing wells at same time. In the fourth photo water has reached all wells, indicating that further injection will not force more oil toward these wells. The blank areas remaining at this stage are considered "blocked off" from the producing wells; and new input or output wells must be sunk to recover oil in these areas. Bottom center photo tells the same story in one composite picture of the various stages of flooding. Bottom right shows how the field appeared before the laboratory flooding operation began. In addition to the black dots for producing wells, circled dots shown here indicate the injection wells which are obscured from view after the flow begins.

Miniature Oil Field Electrically Operated

A device which is designed to add to the world's oil resources by increasing the percentage of recovery has been developed by scientists of Gulf Oil Corporation in the company's research laboratories at Harmansville, Pa. It is in essence a miniature oil field electrically operated. By an ingenious process the miniature field foretells with a high degree of accuracy what will happen in an oil producing area up to twenty years in the future and makes it possible to plan production in such a way as to bring to the surface a greater proportion of the reservoir contents than heretofore.

Maximum oil extraction is achieved by the "Electrolytic Model Oil Field" as it is officially designated through its ability to gauge how water flooding or gas injection operations may be conducted without isolating part of the oil reserve so that it does not flow to the surface. In the model a current of electricity travels through a sensitized material in a manner similar to the way in which a fluid such as gas, water or oil, flows through a porous material such as sand. Thus it is possible to measure by electric current how water and gas injection operations will work out in particular fields, and may be modified for best results.

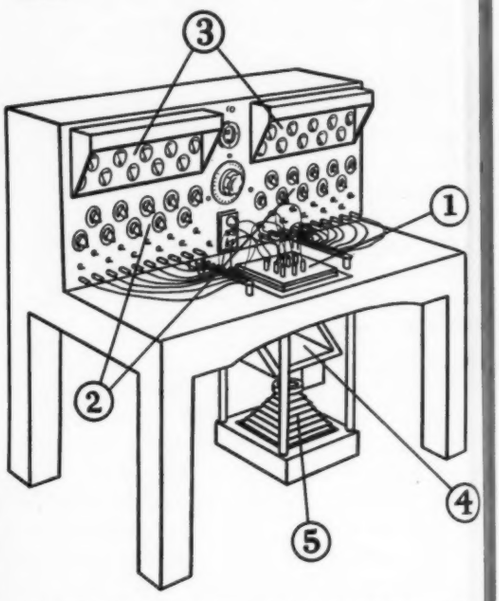
Miniature "wells" — actually small plastic tubes with hollow tips piercing a sensitized mat — are arranged in the same relation and at proportionate distances as in a given oil field. The tubes representing output wells, through which crude oil or oil-bearing gas flows to the surface, are filled with colorless liquid. Those representing input wells, into which water or dry gas is pumped, contain a blue liquid.

The sensitized mat to which they are connected is made of gelatin. As set in the model

Physicist H. G. Botset of Gulf Oil Corporation's Research Laboratories with the "Electrolytic Model Oil Field" he invented.

the mat is not directly visible to the operator, but he views it through a mirror. A camera attachment also records the progress of the forecast operations at close intervals.

Two types of operations may be simulated. One is water flooding, in which water pumped through intake wells forces the crude oil toward the output wells. The other type represents cycling in oil distillate fields. Here oil-bearing gas drawn from the wells is treated to recover the oil. Then the dry gas is pumped back under ground to force additional oil-bearing gas toward the surface and to maintain pressure sufficient to prevent the oil from dropping out and being permanently lost.



Simplified sketch of the "Electrolytic Model Oil Field" helps show how it works. Identified by the Number 1 are the plastic tubes representing input and output wells. No. 2 are the control knobs which adjust the flow, in or out, for each well. The flow is measured by the dials, No. 3. Beneath the wells a tilted mirror, No. 4, enables the operator to view the progress of the flow pattern, while a camera, No. 5, records the flow in pictures.

Once the ideal operation is worked out on the model, it can be translated directly to action in the field, since the rate of flow and volume of current can be transposed accurately into terms of fluid fed into the actual input wells. The sinking of new input or output wells or neutralization of others is also undertaken as a result of the experimental arrangement which worked best on the model.

Studies of gas injection and water flooding on the electrolytic model obviously represent theoretical conditions seldom exactly encountered in actual practice. However, when scientists temper these results with their information on the geological structure of particular fields, the final deductions show improved accuracy.

The model, which can represent a field of up to 20 wells, is about the size of a home workbench, with an upright instrument panel and with the miniature field set horizontally in the center. In analyzing large areas, the area is divided and handled in sections.

To make a forecast of oil field history for the next score of years takes the model not more than three hours.

★ ★ ECHOES FROM THE WASHINGTON OIL FRONT ★ ★

By W. J. Maddox, *Chief of World Petroleum Washington Bureau*

Farewell Appearance

Ralph Davies

THE recent three-day session of the Senate Special Oil Investigating Commitee, given over almost entirely to to presentations by PAW officials may well make petroleum history. Among all the hearings held thus far by the group, this series is outstanding. Taken as a whole, the testimony given is a history of oiling the war, the "now it can be told" sort of stuff, but beyond this it points the way to the need for a sound domestic and foreign oil policy for this country.

The PAW galaxy included Administrator Ickes, Deputy Administrator Ralph Davies and ten of the eighteen directors: H. Chandler Ide, Howard Page, Philip H. Bohart, W. B. Heroy, A. P. Frame, C. Stribling Snodgrass, James E. Pew, Walter Hochuli, Roy F. Hawkins and George A. Wilson.

In what may prove to be his swan song as a public servant before a Congressional commitee, Davies urged a strong overseas position for the American industry. "It is nearly 35 years too late", he said, "to talk of a non-importing domestic oil economy; every year since 1911 the United States has imported crude oil or refined products or both.

"Before a great many years, more oil will probably be produced abroad than in the United States, even if the pre-war rate of domestic production should be maintained. To deny the benefits of this foreign production to American consumers might subject them to the payment of unduly high prices for products. To deny foreign crude to domestic refiners might force abroad an increasing amount of the refining of foreign oil and thereby lessen our exports.

"If another war should come, despite all efforts to maintain world cooperation and world peace, it may be of vital importance that American nationals be in control of a fair share of the world's oil fields. In this war the United Nations have had access to the four principal producing areas—the United States, the Caribbean, the Middle East, and Russia. It might be fatal not to have a similar position in another war. Reasons of security as well as of economics call for vigorous American oil activity abroad.

"One essential to such activity is equality of opportunity for American citizens. Our nationals should have the same rights that are enjoyed by the nationals of other countries and that we accord to other nationals here."

API's Capitol Set-Up

James E. Moss

API'S decision to maintain an office in Washington is generally looked on as a sound move toward continuing the cordial relations built up during the war between the industry and the executive and legislative agencies of the government. Desirability of closer contact between the industry and government in view of the many complex problems ahead relating to petroleum has been touched on by witnesses before the Senate Special Oil Investigating Commitee and echoed by members of the commitee themselves. The work of the Senate group itself, in formulating a domestic and foreign oil policy for the United States, is one of the more important concerns of the legislative branch in which industry advice is needed.

In this, as well as in dealing with numerous other questions that arise from time to time, the Washington office will be able to maintain contact with Congress and the various government bureaus concerned with oil. According to present plans the office here will be a small but compact organization. API President William R. Boyd plans to make the Washington office his headquarters, although dividing his time between here and New York. As his assistant he will have Joe Dwyer who has a wide acquaintanceship on the Hill.

API's new Transportation Division, located at Washington, has as its director James E. Moss, who during the war was the Institute's tanker consultant. Moss was formerly head of the marine department of Atlantic Refining. He is a graduate of the Naval Academy and a retired Navy officer. His services as consultant were extremely valuable during the war in carrying out the Institute's safety program.

The decision to add Transportation as the fourth division of the Institute's set-up made, at the Chicago meeting in November, is designed to tie the industry closer to government activities in that field, the ICC, and Bureau of Navigation.

API's other three divisions are expected to remain as established at present—Production at Dallas, Refining at New York, and Marketing at New York. There may be some slight question about continuing the last named at New York but that is considered still to be a good spot from which to operate.

Curtain for PAW

AS Petroleum Administrator Ickes and his Deputy Ralph Davies promised on V-J Day, PAW has rung down the curtain, and the greatest team of oil men ever put into one line-up has scattered to the far corners of the petroleum world back to their industry jobs. All that remains of the oil war machine is a small force of a dozen or so employees needed to wind up the records and finish off certain routine matters before the final whistle is blown. You might picture the once teeming PAW sections of the Interior Building as wings of empty offices with deserted corridors. But, instead of oil men, the visitor now sees furtive scouts of the old Interior bureaus that were forced to move to other cities to make room for wartime activities. They want to move back and for several months have had space-hungry eyes on PAW's quarters.

Price Control to Stay

Sumner Pike

OPA's fuel price chief, Sumner Pike, is letting it be known that he intends to "hold the line" on crude prices for some time to come, maybe a year or even more. His theory is that price control is as vital now in peacetime as it was during the war because of the short supplies of raw materials. This line of reasoning carries no weight with IPAA General Counsel Russell Brown, who during the war was one of the foremost advocates of a hike in crude prices to stimulate exploration and production. Brown contends that raw materials are not lacking, and that while rationing has been removed OPA's price control keeps the industry from operating normally under peacetime conditions.

(*Continued on page* 78)

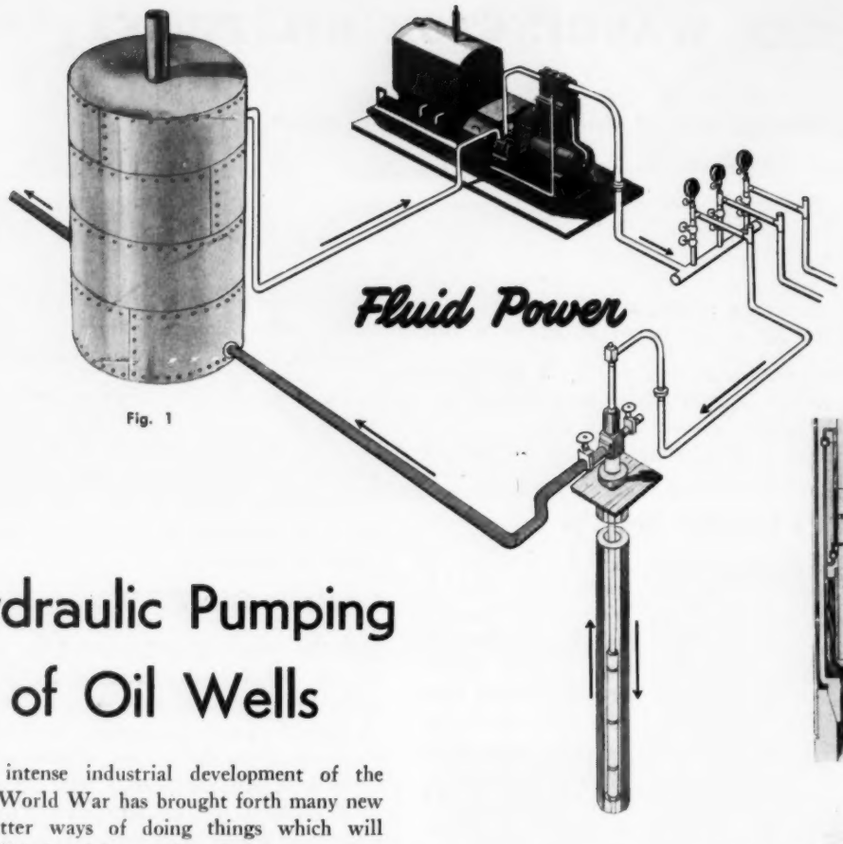


Fig. 1

Hydraulic Pumping of Oil Wells

THE intense industrial development of the second World War has brought forth many new and better ways of doing things which will affect all industrial operations for years to come.

Important among these new methods has been the greatly expanded application of hydraulics for power transmission. Fluid under pressure has made many difficult power problems easy and has radically affected the design of many machines. The small, light and compact nature of the equipment; the fact that its fluid power can be carried by small pipes to wherever it is wanted, and the positive action it furnishes, have all contributed to the greatly expanded use of these systems.

In the field of aeronautics alone, hydraulic power transmission has contributed greatly to the advancement in design of current machines. Whether feathering propellers or retracting landing gear, whether opening bomb bay doors or operating flying controls, hydraulic transmissions have saved weight, offered simpler application and have given more dependable action than obtained by other methods.

So, too, in tanks, in half-tracks, in PT boats, on trains, in machine tools, and in countless other ways fluid power is helping do power jobs simpler and better than ever before.

What could be more natural than pumping oil with oil? Here, again, hydraulics offer a better method of power transmission, allowing many advantages in lightness and compactness of application and positive action which is opening new fields of opportunity for lowering production costs and improving pumping practices.

Fig. 2

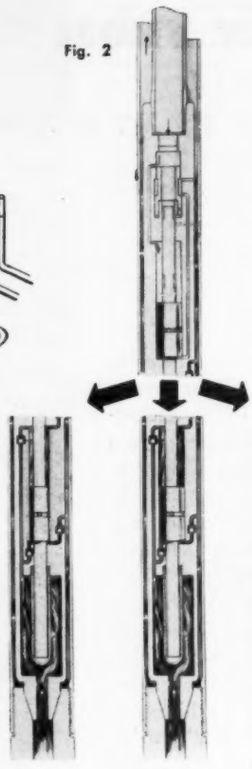


Fig. 3

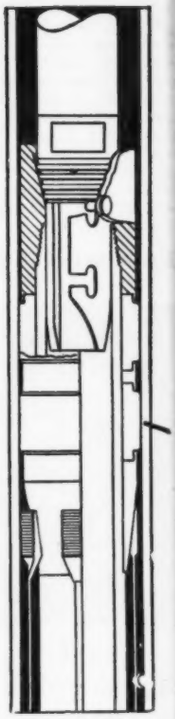


Fig. 4

In the petroleum industry the hydraulic principle has been usefully applied to the pumping of oil from both shallow and deep wells. An arrangement for this purpose is illustrated by the accompanying drawing, Figure 1. On the left is a tank containing clean oil which is to serve as the means of transmitting hydraulic power to a pump in the bottom of a distant oil well. This oil is fed to a triplex pump where a pressure of a few hundred to 5000 lbs., depending on the depth of the well, is built up to the requirements of the job. After sufficient pressure has been developed, the fluid power is admitted to a manifold, where it is metered by flow-control valves and distributed through pipes to the heads of the wells in the oil field. From the top of the well the power oil is conducted to the bottom of the hole where the production unit is located, and where the pumping is done. This production unit consists of two principal parts, one containing an engine piston and the other a displacing or pumping piston. The fluid power actuates the Kobe engine piston (Fig. 2), while the responding action of the Kobe pump piston (Fig. 3) sucks production oil from the well bore and forces it, along with the spent power oil, to the surface through the tubing string or casing. When it reaches the surface all the oil is delivered to storage tanks, from which it is drawn off for transportation through the pipe lines. An amount of oil equal to the amount necessary for operating the hydraulic pumping system is cleaned by settling and returned to the tank which supplies the triplex pump.

This system presents a great contrast with the ordinary method of lifting oil by means of a beam pump installed in each individual well. The first point of difference is the absence of all mechanical linkage, from the surface power unit to the production unit at the bottom of the hole. The power is simply delivered to the point where it is to be used through a pipe. A single pumping unit at the surface can thus serve a number of wells.

(*Continued on page 70*)

Fig. 5

Fig. 6

THE M. W. KELLOGG COMPANY

Subsidiary: THE KELLEX CORPORATION

NEW YORK, N. Y. • JERSEY CITY, N. J. • LOS ANGELES, CAL. • TULSA, OKLA. • HOUSTON, TEXAS • LONDON, ENG.

Hydraulic Pumping

(*Continued from page 62*)

The hydraulic system can serve deep wells as easily as shallow wells, because the column of oil in the power tube balances the column of oil in the production annulus. This is a great simplification because the weight of thousands of feet of pumping rod in the ordinary system is eliminated, and the lifting problem is reduced to the problem of lifting the oil from the producing formation only.

Hydraulic power also makes the pumping of crooked wells a fairly simple matter. A hydraulic production unit can be installed in any place where it is possible to run tubing, through which fluid power may be applied to run the pistons of the unit. This is a considerable advantage because, as is well known, pumping rods are difficult to operate and are subject to wear in crooked wells. But where all mechanical linkage is done away with, a crooked hole becomes an ordinary pumping problem.

Since the power is delivered where needed through pipes, hydraulic pumping may easily be applied to wells in inaccessible places, in flooded areas or other kinds of difficult terrain, and all controls may be located at the central power station in an accessible place.

Large volume wells, with fluid capacities as great as 4,000 barrels a day, are now being hydraulically pumped, and there does not appear to be any reason why larger volumes might not be handled.

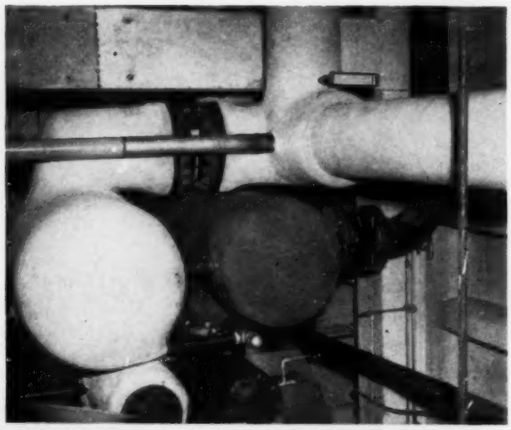
Hydraulic pumping is more easily subject to regulation than mechanical pumping, because surface gages can be installed to constantly reflect pumping efficiency, fluid levels, bottom hole pressures, pump-off conditions, etc. The system has a large advantage in movability, as the same pump and surface power unit will produce either a 2,000 or a 10,000 foot well.

The hydraulic system is economical of steel. This system permits light, compact design, which effects savings of up to 75 per cent of the steel used for equipping oil wells in the ordinary manner with beam pumps. Hydraulic power is by nature highly efficient, and usually reduces horse-power requirements for oil pumping by one-third to one-half of the conventional requirements.

In the hydraulic pumping of oil wells the production tubing may be eliminated and the well produced through the casing. For this purpose a packer is installed, as shown in Fig. 4. There are thus no moving parts to damage the casing.

A Kobe triplex pump and power unit designed for hydraulic pumping is shown in Fig. 5. This pump is of the vertical type which economizes in weight and makes it possible to introduce many features that have proven advantageous in American automotive design, such as splash or pressure lubrication of gears, crankshaft, crossheads and connecting rod bearings, besides making possible the use of higher crankshaft speeds. They are equipped for either direct or belt drive. The engine end of the Kobe production unit shown in Fig. 2 is always the same for any given size, but various pump ends can be attached to standard engine end sizes. This permits a wide range of pumping volume, so that as the fluid capacities of the wells may change, pump ends can be changed to fit new pumping requirements. For each standard Kobe engine end there are three pump sizes corresponding to different rates of delivery, which can be further varied by speeding up or clowing down the action of the engine end. Fig. 6 shows a 40-horse-power triplex pump that is furnishing centralized power for fourteen 3500-foot wells.

Call STEVENS
4-3072 Tulsa
INSULATION
Specialists

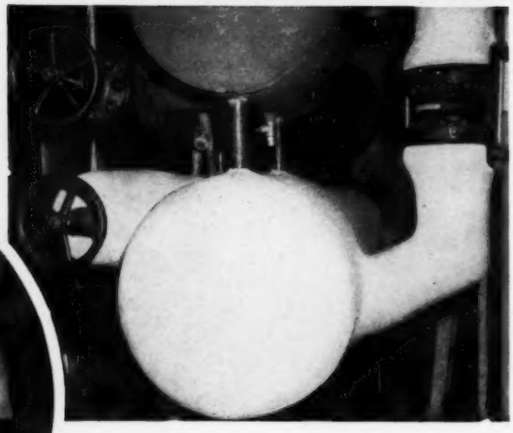


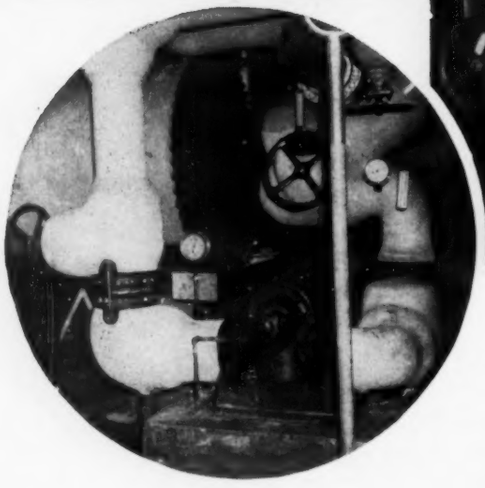
Illustrated are three views of recent STEVENS Insulation installation on the air condition unit for the National Bank of Tulsa building.

33 YEARS EXPERIENCE

In Insulating, Gaskets and Packing Material go into every STEVENS job.

Factory Representatives with complete stocks of insulating materials.





for ANY size
Gasket
for *EVERY Job!*

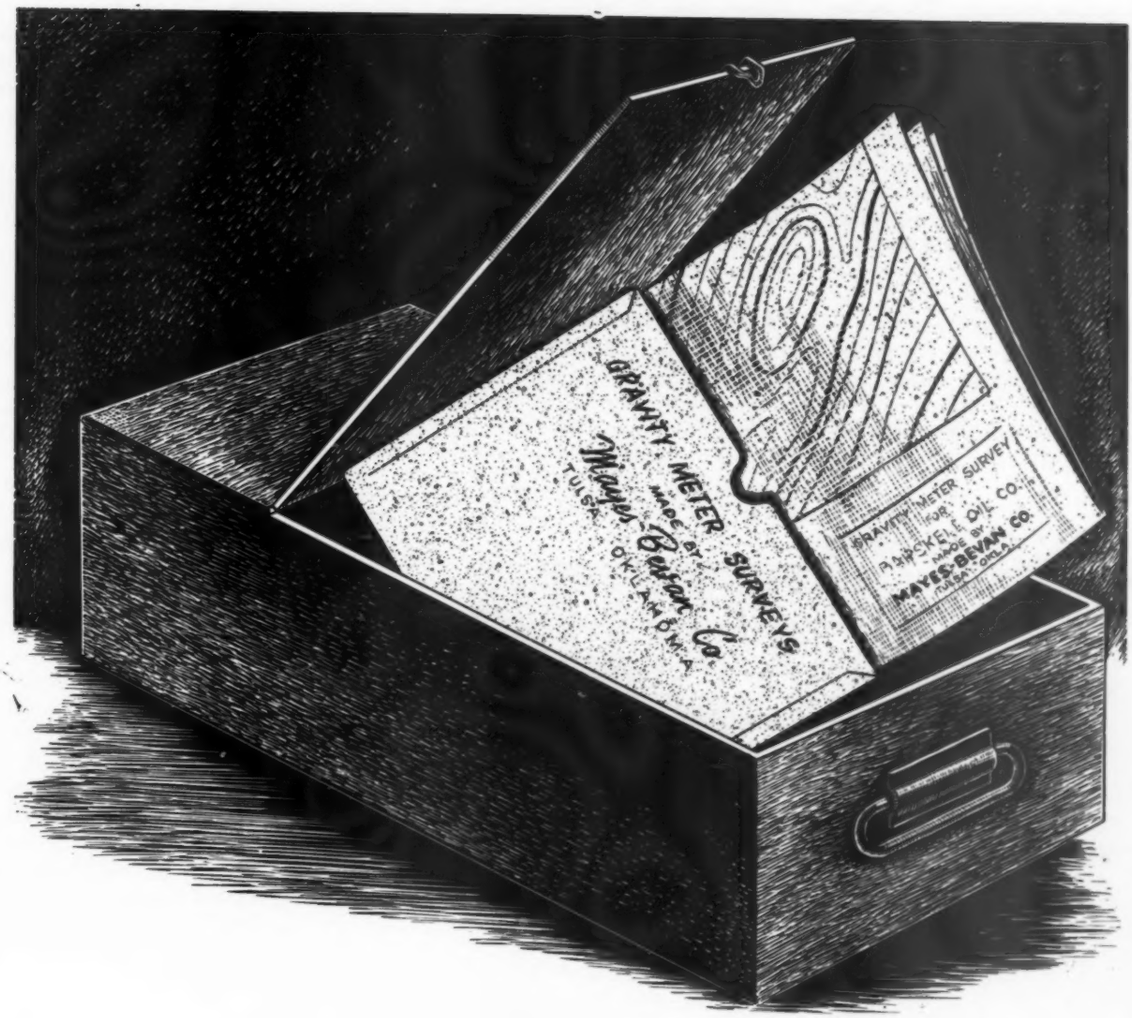
STEVENS Ring Type Cylinder Head Gaskets. Guaranteed not to blow-out or burn-out under pressure. The best cylinder head gasket made for any gas engine your money can buy—not a critical material.

Gaskets of Copper, Aluminum or other metals.

All types of Rubber Gaskets.

We can build any size or type gasket — you furnish the drawing or template.

STEVENS ASBESTOS PRODUCTS CO.
GASKET MANUFACTURERS INSULATING MATERIALS AND CONTRACTORS
322-4-6 East First St. *Call 4-3072* Tulsa, Oklahoma



An INVESTMENT In The FUTURE

A Mayes-Bevan Survey is indispensable in the exploration of new oil provinces and its value will increase many fold with the development. The quantity of gravity meter work being done in the proven oil provinces of the United States is a demonstration of its continued value.

Mayes-Bevan Company M/B *Gravity Meter Surveys*

KENNEDY BLDG. • TULSA, OKLA.

Interpretation of Surveying Records

THE computation of the course of a bore hole from survey records obtained is a simple but also a long and tedious procedure. The mathematics involved are known to any high school student and offer no difficulty in their solution.

An accurate survey of a bore hole involves at lease 100 or more records. The calculations to be made, based on these records, require considerable time. There is also the possibility of errors being made in most calculations, which may affect the course of the hole to be determined.

To provide a speedy and accurate procedure to determine the course of a bore hole the Sperry-Sun Well Surveying Company has prepared a set of Tables which completely eliminate the making of calculations and immediately furnish the desired results. These Tables give the results for angles of inclination in quarter degrees from 0 to 31 and in half degrees from 31 to 45 and in degrees from 45 to 55 for bearing angles in degrees ranging from 0 to 90.

To obtain the result it is only necessary to refer to the Table, select the vertical column of angle of inclination and the horizontal column of bearing and obtain the Latitude, which is the distance North or South, and the Departure, which is the distance East or West from the vertical through the mouth of the well or from the vertical through the preceding point.

The Tables give the values of the Latitude and Departure for each one hundred (100) feet course length. They also give the true vertical depth for each angle of inclination. Geometric calculations are completely eliminated and only in cases where the course length is more or less than 100 feet it is necessary to multiply proportionately the values obtained from the tables.

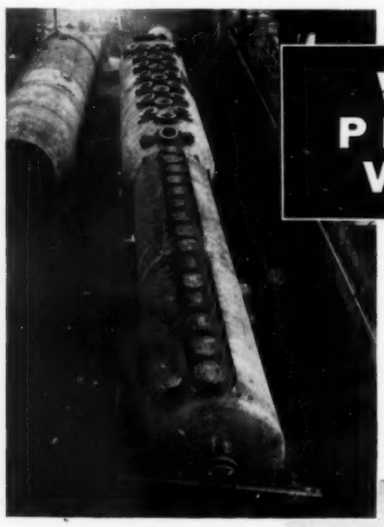
The tables also contain a section dealing with the Correction of Magnetic Compass Records, a subject which is frequently overlooked when magnetic compasses are used for recording the angle of bearing. This section not only explains the influence of permanent magnetism of the bit and drill pipe upon the compass record obtained, but gives information for the determination of the strength of the magnetic field produced by a drill stem or drill bit and for the determination of the Angle of Correction.

These tables have been prepared with great effort and expense by Sperry-Sun Well Surveying Company and have been used in their organization for many years. Sperry-Sun has received many requests for these publications and on account of their usefulness to the oil industry, Sperry-Sun has agreed to their publication. These tables can now be obtained at the price of $5.00 per copy through the Sperry-Sun Well Surveying Company, 1608 Walnut St., Philadelphia.

New Petroleum Register Published

THE 1945 Petroleum Register now is ready for immediate delivery. Because of war-time paper shortages no register was published in 1944, consequently the new edition contains even more revisions than usual with this long-established directory. Thousands of new names have been added in the course of complete revisions.
Every branch of the oil industry is covered in the new Register — drilling, production, refining, natural gasoline, transportation and marketing. The South American section has been given special attention. In all, there are 19 sections in the large volume.

Orders may be placed with World Petroleum, 2 West 45th Street, New York 19, N. Y. or Georgian House, St. James, London, S. W. 1. Price postpaid is $10.00 in the United States. $12.00 elsewhere throughout the world.



WELDED PRESSURE VESSELS

HYDROGEN PLANTS
as applied to
CRACKING OF PETROLEUM
HYDROGENATION
OIL SYNTHESIS

5'-0" & 6'-0" DIA. x 72'-0" TOTAL LENGTH

5'-0" & 6'-6" DIA. x 90'-6" TOTAL LENGTH

OUR WORKS ARE EQUIPPED WITH
X-RAY APPARATUS
AND
MODERN TESTING LABORATORY

DISTILLATION PLANTS
FRACTIONATING COLUMNS
HEAT EXCHANGERS
STRIPPERS
VACUUM TOWERS
EVAPORATORS
CONDENSERS

8'-0" DIA. x 39'-6" LONG

ASHMORE, BENSON PEASE & CO. LTD.
and associate company
THE POWER-GAS CORPORATION LTD.
STOCKTON-ON-TEES

Fine **STEELS**

CAST OR FORGED FOR
THE OIL INDUSTRIES

"ERA" H. R. HEAT RESISTING
"ERA" C. R. CORROSION RESISTING
"ERA" MANGANESE WEAR RESISTING

We follow resolutely the tradition of our great founder the late Sir Robert Hadfield, BT., who held that the best was nothing more than a sound basis for further improvement.

The development of Fine Steels was his life work and we are not only upholding, but by continued study and research, striving to enhance the great reputation attaching to his name.

HADFIELDS
SHEFFIELD

• HADFIELDS LTD EAST HECLA WORKS, SHEFFIELD, ENGLAND

No 3046

Leonard To Build Thermofor Unit

LEONARD REFINERIES, INC., Alma, Michigan, has contracted with Houdry Process Corporation for the erection of a Thermofor Catalytic Cracking unit. It is the first small scale unit to be built with private capital to operate for post-war motor gasoline production.

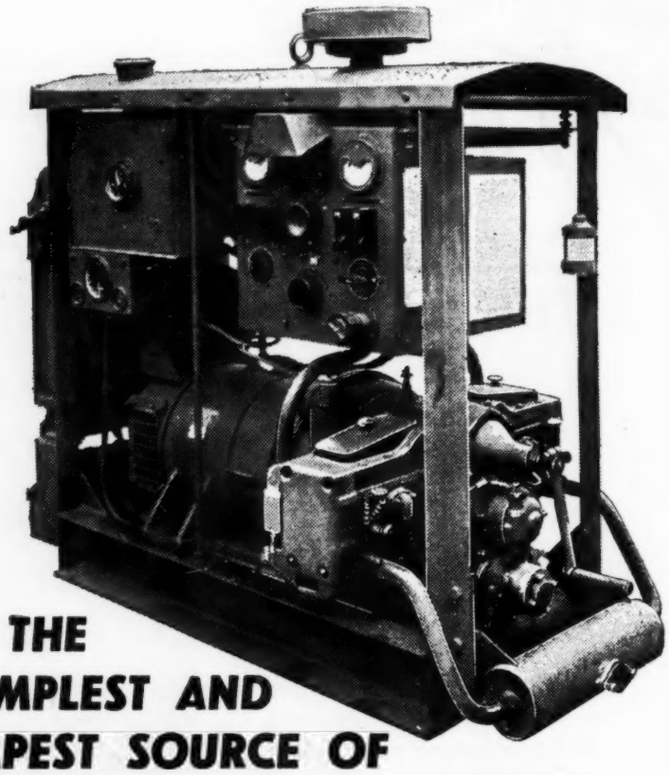
The small integral TCC unit has been designed by Houdry engineers to process 3,000 B/D of charge stock. While the unit embodies a number of design simplifications, it is, nevertheless, very similar to the larger TCC units built for the war program. The simplifications include integral elevator design for both spent and regenerated catalyst. Increased catalyst rates make possible the elimination of vapor superheaters.

Reid Brazell, president of Leonard Refineries, Inc., in signing the contract, stated, "We selected the TCC process because of its flexibility of operation, high percentage of on-stream time; high liquid recovery and low operating cost."

Robert B. Cragin, vice president in charge of commercial development for Houdry Process Corporation, in accepting the contract, pointed out that the Houdry research and engineering facilities, together with nearly a quarter century of catalytic know-how, will be made available to Leonard Refineries, as it has been to all Houdry licensees. "This is the sixty-ninth Houdry licensed catalytic cracking unit to be constructed", Mr. Cragin said. "We are pleased to be able to serve Leonard Refineries, whose foresight and leadership will demonstrate the practicability of catalytic cracking for owners of small refineries."

Honor Ex-Mayor of Teague

TUESDAY evening, December 11, was Bill Boyd night in Washington. Members of the Petroleum Industry War Council, Congressmen from both Houses, representatives of PAW, the Army, Navy and other government agencies, together with a host of oil men from all parts of the country gathered in the banquet room of Hotel Statler to do honor to Bashful Bill Boyd, Ex-Mayor of Teague, Texas, for his outstanding service as captain of the industry division of the government-industry team and coordinator-in-chief of relations with official agencies. Officially the dinner was a testimonial from the members of the expiring Petroleum Industry War Council to their retiring chairman. As tokens of their esteem and affection they presented him with a large silver waiter inscribed with their autographs and with a portrait "done in oil" by the celebrated artist, Douglas Chandor. In a graceful response Bill disclaimed any special credit for himself, declared that he had been only an "instrumentality" for carrying out the wishes of his co-workers and thanked one and all for the honors they had bestowed on "a country boy from Texas."

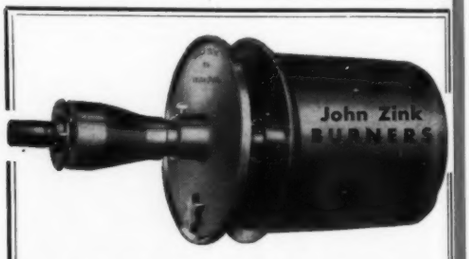


THE SIMPLEST AND CHEAPEST SOURCE OF 8-12 b.h.p. IS A

CUB DIESEL

The horizontal design of the "**CUB**" diesel gives inherent balance. It is a high-speed low-weight engine of 1006 c.c. capacity with a continuous heavy duty rating of 12 b.h.p. at 1,800 r.p.m. The "**CUB**" will start from cold, it will give good service for many years with practically no attention and uses very little fuel.

OIL ENGINES (COVENTRY) LTD.
Atlantic Works, Harefield Road, Coventry



For: Power Boilers — Gasoline Plant Boilers
— Treating Furnaces — Industrial Boilers
— Heating Boilers — Domestic Furnaces
Refinery Stills and Furnaces

◆

"JOHN ZINK PRODUCTS MUST BE GOOD"

JOHN ZINK COMPANY
4401 South Peoria Tulsa, Oklahoma

INDICATING RECORDING N&Z CONTROLLING INSTRUMENTS

Instruments

Instruments of precision with a world-wide reputation.

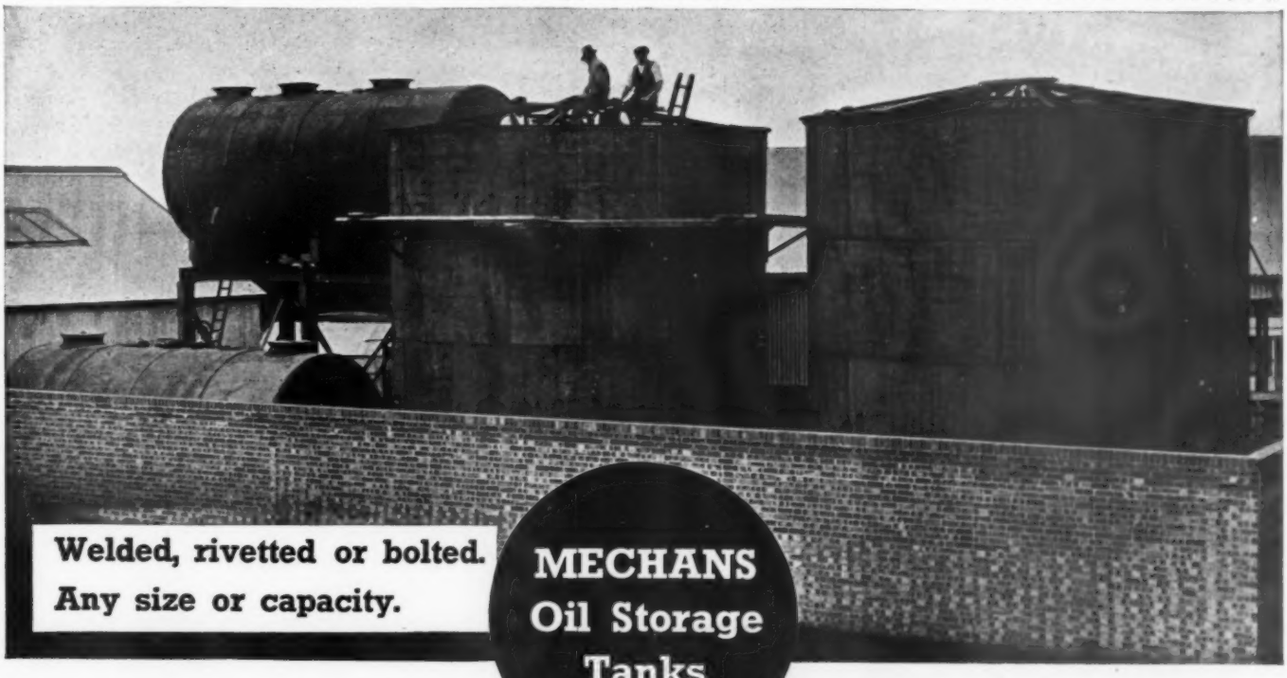
Mercury-in-glass thermometers, mercury-in-steel dial and recording thermometers, pressure recorders, multipoint temperature indicators and recorders, liquid level gauges and automatic temperature controllers. Every instrument is supplied with a guarantee for two years.

NEGRETTI & ZAMBRA

122, Regent Street, London, W.1.

Established 1850

ILLUSTRATION SHOWS TANKS DURING ERECTION AT OIL SERVICE STATION



Welded, rivetted or bolted.
Any size or capacity.

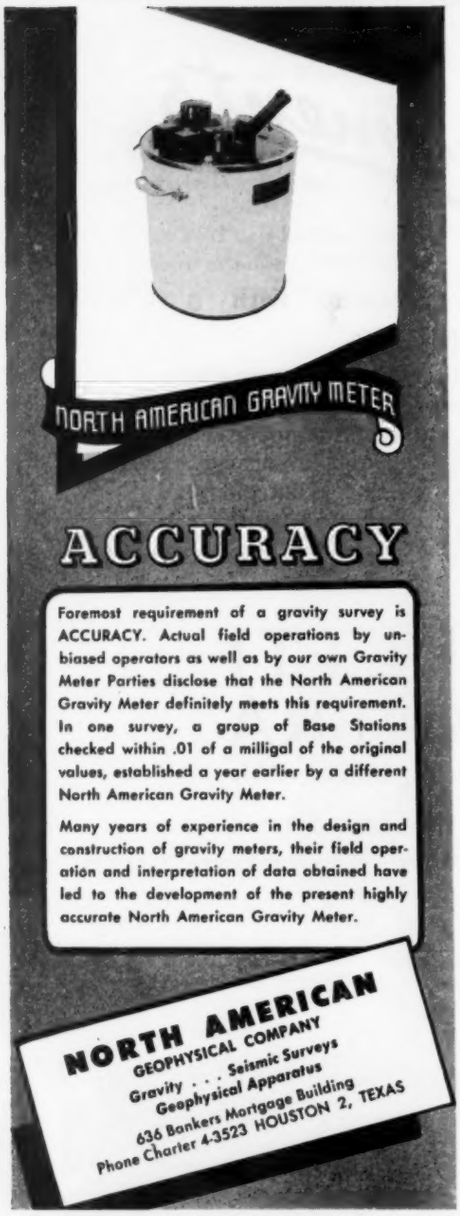
MECHANS Oil Storage Tanks

MECHANS LIMITED

TELEGRAMS: "NAUTICAL, GLASGOW" TELEPHONE: SCOTSTOUN 2211 (SIX LINES)

SCOTSTOUN IRON WORKS, GLASGOW, W.4, SCOTLAND

TELEGRAMS: "ELONGATION, LONDON" LONDON: 10, PRINCES STREET, WESTMINSTER, S.W.1. TELEPHONE: WHITEHALL 4286


NORTH AMERICAN GRAVITY METER
ACCURACY
Foremost requirement of a gravity survey is ACCURACY. Actual field operations by unbiased operators as well as by our own Gravity Meter Parties disclose that the North American Gravity Meter definitely meets this requirement. In one survey, a group of Base Stations checked within .01 of a milligal of the original values, established a year earlier by a different North American Gravity Meter.
Many years of experience in the design and construction of gravity meters, their field operation and interpretation of data obtained have led to the development of the present highly accurate North American Gravity Meter.
NORTH AMERICAN
GEOPHYSICAL COMPANY
Gravity . . . Seismic Surveys
Geophysical Apparatus
636 Bankers Mortgage Building
Phone Charter 4-3523 HOUSTON 2, TEXAS

Oil Company Staff Changes

(*Continued from page 59*)

DR. JUAN PEREZ ALFONSO, recently appointed Minister of Fomento in the new federal administration in Venezuela is 42 years of age, a native of Caracas and a lawyer by profession. Part of his education was obtained in the United States. He completed his legal studies in his native land where the University of Venezuela conferred upon him a doctorate in political and social science.

From his student days Dr. Perez Alfonso has been an active participant in the liberal movement in Venezuela. He joined in the opposition to Gen. Gomez in the latter part of his dictatorship as a member of the student youth organization and later was a prominent member of the Accion Democratica. In 1936 has was selected to represent the Collegè of Lawyers on a committee appointed to draw up a new law code and in 1939 he served on a commission to revise the municipal code of the city of Caracas. From 1938 to 1942 he represented the Federal District in the National Congress and in 1941 he was appointed to a law professorship in the Central University.

In his new post Dr. Perez Alfonso has given assurances that Venezuela's oil policy will not be changed and that the contracts and concessions held by oil companies will be respected.

ROSS W. THOMAS has been appointed executive assistant to vice president G. G. Oberfell of Phillips Petroleum Company. His title will be manager of research and development. Geo. R. Benz succeeds Thomas as manager of the chemical products department.

Ross Thomas started with Phillips in 1926 as construction superintendent. He later did much pioneer work in developing liquefied petroleum gas equipment. Since July, 1940, he has also been president of Hycar Chemical Company, the affiliate jointly owned by Phillips Petroleum Company and the B. F. Goodrich Company to manufacture and market synthetic rubber.

George R. Benz, started with Phillips in 192[illegible] in the engineering department. In 1927 he became interested in liquefied petroleum gas and in 1928 transferred to the Detroit office as sales engineer. In 1940 has was made assistant manager of the Phillips chemical products department with headquarters in Bartlesville.

CHESTER A. BAIRD who since 1941 has held the position of assistant to the president of Mene Grande Oil Company, Venezuelan subsidiary of Gulf Oil Corporation, has been made resident manager of the Venezuelan Atlantic Refining Company. Mr. Baird is a graduate of Ohio State University and prior to his assigment to Venezuela served in various capacities with companies of the Gulf group. In his new post he will have full charge of the Venezuelan Atlantic's activities with headquarters in Caracas.

AT the Papago Park Prisoner of War Camp near Phoenix, Arizona, on November 23rd Major General William E. Shedd conferred the Legion of Merit on Lieut. Col. Verne Austin for exceptionally meritorius conduct. Col. Austin before the war was a petroleum engineer with the State Division of Oil and Gas. He entered the service in February 1941 with the 11th Cavalry, commanding its First Squadron. In April he was transferred to the Army Industrial College in Washington and upon completion of his training there he was assigned to the office of the Under Secretary for War and acted as liaison officer with the Petroleum Administration for War. In February 1942 he was sent to Los Angeles in charge of plant protection on the Pacific Coast and in September he was placed in charge of the Japanese segregation center at Tule Lake, California. From there he went to Papago Park as commander of the camp.

Lieut. Col. Verne Austin

OIL DISTRIBUTION

The Great Western Railway Company's South Wales Docks at CARDIFF, SWANSEA, NEWPORT, BARRY, PORT TALBOT and PENARTH (Harbour) are excellent terminals for oil distribution.

SITES FOR NEW DEPOTS ARE AVAILABLE

For information apply to the respective Dock Managers or to :—

Chief Docks Manager,
Great Western Railway,
CARDIFF
Paddington Stn. London, W.2

OIL TANKERS AT G.W.R. DOCKS

JAMES MILNE, *General Manager.*